POPULATION ANALYSIS

WITH

MICROCOMPUTERS

Volume II (Extract B)

SOFTWARE AND DOCUMENTATION
Rural-Urban Projection (RUP)
Program

By

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PREFACE

The main purposes of this manual are to encourage developing countries to make a primary analysis of population information and to make it easier for them to do so.

The U.S. Census Bureau, through the International Programs Center (IPC), provides demographic training to population analysts in developing countries. This training is offered as seminars, workshops, and technical assistance for persons interested in doing a demographic analysis of the population. It focuses on: a) the methods and techniques available for analyzing the base data on the demographic situation in a country; and b) the use of microcomputer programs to perform the calculations quickly and accurately.

Both the Census Bureau and sponsoring agencies have recognized the need for a manual containing the selected topics presented in the seminars, both as a textbook during the training and as a reference for later use. Until now, the seminars and workshops were offered with a set of references to articles and books that required a solid educational background in the fields of demographic techniques and mathematics. With a view to simplifying the explanation of the demographic techniques and their implementation through microcomputer programs, we undertook the task of producing this manual.

Our goal was to produce a textbook avoiding mathematical derivations of the techniques frequently used in basic demographic analysis. Instead, we wanted to provide a textbook that can be easily understood, given the concepts of the demographic indices and techniques presented, but with references to more detailed sources. The text offers mainly the concepts, while the appendices present a more technical description.

The principal contribution of the manual is not only the easily readable text, but also a set of spreadsheets developed during recent years for analyzing census and survey information. These Population Analysis Spreadsheets were designed and developed primarily by the author, but with significant contributions from his colleagues in the Center.

A set of computer diskettes containing the spreadsheets is distributed
with the manual and written documentation. The manual and spreadsheets are
not copyrighted and can be widely copied and used. Another computer package
extensively mentioned in the mortality chapter is the United Nations MORTPAK
package. MORTPAK, as well as the united Nations program QFIVE, is distributed
separately. Users of this manual can obtain the United Nations programs by
writing to the following address.

```
To request MORTPAK and QFIVE, write to:
The Director
Population Division/DESA
United Nations
Room DC2-1950
New York,  NY 10017
Fax: (212) 963-2147 or (212) 963-2638
```

My software associate, Peter D. Johnson, not only contributed some of the
spreadsheets, but also undertook the task of standardizing the presentation of
the spreadsheets and their conversion from SuperCalc to Lotus 1-2-3 and
Microsoft Excel.   Finally, he wrote the software and documentation of the
computer program (RUP) for projecting the population, as presented in
Volume II.

My editorial associate, Ellen Jamison, made a substantial contribution
by rewriting much of the text from the user's point of view. She also made
useful suggestions regarding format and presentation. Finally, she edited the
complete text and made recommendations for improving the documentation of the
spreadsheets.

Any errors that remain are my own responsibility.

The manual has two volumes. Volume I includes the technical and
theoretical aspects about how to analyze the population information. At the
beginning of each chapter, an overview of the contents is presented. A
reference table indicates the methods and software that can be used according
to the available information. Volume II presents the documentation of the
Population Analysis Spreadsheets and population projection program. The
spreadsheets are presented in alphabetical order.

Eduardo E. Arriaga
July 1993

Revised by Peter D. Johnson
May 2003

ACKNOWLEDGMENTS

INTRODUCTION

This document is a subset of Volume II of the manual, <u>Population Analysis with Microcomputers</u>, by Eduardo E. Arriaga and Associates.

This document contains the documentation of the Rural/Urban Projection Program (RUP). For more information about RUP, including updates, see: <u>http://www.census.gov/ipc/www/rup/</u>.

Soon after the orignal publication of the manual, a DOS-based system for using RUP was developed. That program is called RUPMENU.

We are currently in the process of developing a Microsoft Excel-based interface for RUP called RUPEX. Information about this system will be given on the web page noted above.

NOTE: Revised text is generally shown in Ariel font. Page numbers are not the same as in the original (1994) publication.

Chapter V

THE RURAL-URBAN PROJECTION (RUP) PROGRAM FOR PROJECTING THE POPULATION

Chapter Contents

A. Overview

1. This Chapter in Brief

The RUP program of the U.S. Bureau of the Census is designed to project either the whole population of a country, its rural and urban populations, or any area. This chapter describes how the program carries out the projection and provides instructions on how to use the program.

The first part introduces the RUP program, including a description of its features; a detailed examination of a sample input file; and examples of the types of output that can be obtained. The RUP Input Summary (pages 25-27) contains most of the format information needed to create an input file. Once you are familiar with the RUP program, it will be easier to refer to this RUP Input Summary than to the detailed input instructions presented in part D.

Part B is only partially included. It discusses some of the operational details.

Part C is no longer needed. See the separate RUPEX or RUPMENU documentation.

Part D contains a detailed discussion of the input to RUP, including samples of different options available for some of the parameter records. You should read Section 2.2 (General Structure of Input to RUP, pages 31-36) to get a general orientation to the input structure, then refer to the RUP Input Summary (Part A, Section 4, pages 25-27) for format information for each parameter record. If you need more detailed information about any parameter record, refer to Sections 2 through 8.

Part E. For a list of the files on the RUP distribution disk, see:
http://www.census.gov/ipc/www/rup/filelist.txt.

Part F outlines the program requirements for running the RUP program.

Part G presents some of the methods used by the RUP program to project the population.

Part H lists the error messages that may be generated when you run the RUP program and explains how to correct the problems.

2. Features

        The most commonly used method for projecting populations is the cohort component
method which projects each age and sex cohort over time based on the components of
growth. Annual births create new cohorts, while existing cohorts are decreased by
mortality and either increased or decreased by migration.

        The RUP program has features that allow a considerable amount of flexibility for
specifying projected trends in fertility, mortality, and migration. It also includes
a wealth of output options that allow a detailed examination of the results. These
features are described below.

(1)   The projection is performed by single years of age. This feature allows you to
        obtain data for special age groups that do not fall into conventional 5-year age
        groups. It also allows you to track population cohorts that may be smaller or
        larger than surrounding cohorts due to past demographic events.

(2)   The projection is performed year by year. This feature allows you to input
        information on demographic events for a particular year (e.g., excess mortality
        due to an earthquake) without spreading the effect over a 5-year period. It
        also provides planners with estimates for each year without having to
        interpolate between data for surrounding years.

(3)   Input data for the population and components can be provided in either single
        ages or 5-year age groups. The age groupings of each item are independent, so
        you can input 5-year data for some items and single-year data for others. The
        program converts all data to single years of age before performing the
        projection (see part G, pages 79-91, for details).

(4)   The open-ended age group in your input data can vary between 50 years and over
        and 100 years and over. In spite of doubts regarding the accuracy of data for
        the population at the oldest ages, projections should be made using the highest
        possible open-ended age group to more accurately represent the population
        dynamics. If you desire, you can still aggregate your results with a younger
        open-ended age group.

(5)   The program accepts mortality and fertility rates as input (as do most
        programs), and it also allows the input of numbers of births, deaths, and/or
        migrants. This feature allows you to update a base population with recent
        actual data on vital events. For instance, if your country has census data for
        1982 and registered deaths and births as well as migrants from 1982 to 1989, you
        can include these actual data in the projection without having to estimate
        rates. In this case, the program would project the 1982 population by age and
        sex using life tables consistent with the numbers of deaths (by age and/or sex
        if available) and mortality patterns for surrounding years, ASFR's consistent
        with the numbers of births (by age of mother if available), and the known number
        of migrants for the years 1982 to 1989. For subsequent years, the program would
        use the projected trend of these components as specified in the input.

(6)   You can provide input data for any year, including years prior to or following
        the projection period. The choices for each component (mortality, fertility,
        international migration, and internal migration) are completely independent.
        For example, a projection starting in 1970 can have fertility inputs for 1970,
        1977, and 1995 and mortality inputs for 1965, 1975, and 2000. Data inputs for
        years outside the projection period are used to interpolate estimates for years
        during the projection and/or as patterns of the age structure of the particular
        component.

(7)   The program provides output of a wide variety of demographic measures for any
        specified year of the projection. These outputs include:

        (a)   Population by sex and age (single years, 5-year age groups, special
                groups) and summary measures of age (e.g., percentages, sex ratios,
                median ages, dependency ratios).

        (b)   Summary vital rates (e.g., crude rates, life expectancy, infant mortality rates, and total fertility rates).

        (c)   Life tables.

        (d)   Net numbers of migrants or migration rates by age and sex.

        (e)   Number of deaths, by age and sex.

        (f)   Number of births, by age of mother, and age-specific fertility rates.

(8)   You can make the projection for one or two areas. If two areas are projected, the program can calculate a third area as the sum of the two areas (e.g., total = rural + urban) or the difference (e.g., urban = total - rural).

    The flexibility described above has the clear advantage of allowing a demographer to create a projection model that accurately reflects what is known about the demographic situation in a country and making maximum use of available data in as close as possible to its original form. However, this flexibility comes at a price as it places a burden on you as the user (1) to decide on the best way to model the situation (since the program does not limit the options) and (2) to provide accurate data for all the inputs required to run the program.

NOTE: The RUPAGG program can be used to aggregate separate RUP projections. Thus, RUP projections of provinces can be combined into a total country projection. See separate documentation of the RUPAGG program.

3. Sample Input and Output

This section presents a sample input file to show you some of the capabilities of the program. It illustrates the simplicity of the input file and shows the wide variety of outputs available.

3.1 Sample Input

Page 13 presents an example of a RUP input file. It is the RUPTSTA.IN file that is included on the RUP distribution disk. The input file consists of <u>records</u> or <u>lines</u> of input. We will describe the function of each record (line) in the file.

There are three types of records:

(1)   <u>Parameter records</u> specify the different options and types of data needed to run the program. These records start with a record type of 1 to 4 characters and are generally defined by those characters (see table 1, pp. 318-319).

(2)   <u>Data records</u> are just data (numbers), such as the population by age and sex or age-sex-specific central death rates or text (see Section 1.2, page 36).

(3)   <u>Comment records</u> are input lines that begin with an asterisk (*) in the first column. These records do not affect the projection but allow the user to document the sources of input data or assumptions, separate sections of input, etc.

The first record (line 1) is a <u>TITL</u> record, which indicates that title records will follow. In this case, the "1" in column 20 indicates that there is only one title record. Line 2 is the title record itself, so that the text "RUPTSTA--TOTAL COUNTRY ONLY" will appear on each page of output.

Line 3 is the <u>N5</u> record, which indicates that the default age grouping of input data is 5-year age groups. The 17 in columns 19-20 indicates that the projection should be performed with 17 5-year age groups, from 0-4 to 80 years and over.

Line 4 is the <u>PROJ</u> record, which indicates how far the population should be projected. In this case the "1990" in columns 7-10 means the projection should end in 1990.

Line 5 is the <u>SXRB</u> record, which gives the sex ratio at birth. In this example, the value "1.02" in columns 17-20 indicates that in this projection there will be 1.02 male births for every female birth.

```
Sample input file: RUPTSTA.IN
--------------------------------------------------------------------------------
Line *     10        20        30        40        50        60        70        80
---- *--------|---------|---------|---------|---------|---------|---------|---------|
 1.   TITL           1
 2.   RUPTSTA--TOTAL COUNTRY ONLY
 3.   N5            17
 4.   PROJ  1990
 5.   SXRB          1.02
 6.   REG            1
 7.   TOT
 8.   * COMMENT LINES CAN BE USED TO DOCUMENT THE SOURCES OF INPUT DATA
 9.   POP M51985          156218.
10.      722278    601552    531057    613793    703468    654624    531398    416520
11.      328363    270353    213639    166875    121324     80000     40000     20000
12.       10000
13.   POP F51985          155191.
14.      718820    599948    525649    476192    456479    413302    343960    278834
15.      225361    187277    146269    107610     73955    100000     50000     25000
16.       12500
17.   ********************************************************************************
18.   * FIRST LIFE TABLE PRE-DATES BASE YEAR OF PROJECTION
19.   MX  M51980
20.      .09828    .00845    .00124    .00273    .00463    .00716    .00943
21.      .01237    .01548    .02073    .02513    .03339    .03982    .05000    .06000
22.      .07000    .08000
23.   MX  F51980
24.      .09359    .00836    .00138    .00105    .00180    .00264    .00372    .00499
25.      .00665    .00829    .01118    .01347    .01940    .02478    .03000    .04000
26.      .05000    .06000
27.   MXM M51985    62.06
28.   MXM F51985    67.61
29.   MXM M51990    64.00
30.   MXM F51990    70.00
31.   * ULTIMATE LIFE TABLE
32.   MX  M52100      .12      1.30
33.     .004702   .000286  .0000672  .0002887  .0005264  .0007616  .0006788  .0007806
34.    .0011155  .0016384  .0027132  .0042289  .0063520  .0098638  .0156264  .0253448
35.    .0423668  .0913791
36.   MX  F52100      .12      1.30
37.     .003934   .000296  .0000862  .0001298  .0001810  .0002428  .0003019  .0004275
38.    .0006692  .0010214  .0016147  .0024752  .0036087  .0056070  .0091217  .0156613
39.    .0287332  .0685220
40.   ********************************************************************************
41.   ASFR 51985
42.       0.090     0.240     0.280     0.224     0.140     0.100     0.045
43.   TFR   1985     3.940
44.   ASFR 52010
45.       0.090     0.240     0.240     0.180     0.103     0.066     0.028
46.   TFR   2010     2.955
47.   ********************************************************************************
48.   * MIGRATION GIVEN FOR ONE YEAR WILL BE HELD CONSTANT FOR THE WHOLE PROJECTION
49.   MIGNM51987
50.      -21983    -21983    -19567     11830     25799     -2334     -8310     -7885
51.       -7786     -6503     -4774     -3349     -2810      -800      -400      -200
52.        -100
53.   MIGNF51987
54.      -21986    -21986    -20547    -14805     -5556     -7095     -6746     -4571
55.       -4293     -3749     -3639     -4101     -4104     -1000      -500      -250
56.        -125
57.   ********************************************************************************
58.   * FULL-PAGE OUTPUT, AND LIFE TABLES FOR 1985 AND 1990 ONLY
59.   OUTP  1985           5      1990
60.   OMX   1985           5      1990
61.   END
```

13

```
--------------------------------------------------------------------------------
Line *        10        20        30        40        50        60        70        80
---- *--------|---------|---------|---------|---------|---------|---------|---------|
6.   REG                1
7.   TOT
8.     * COMMENT LINES CAN BE USED TO DOCUMENT THE SOURCES OF INPUT DATA
--------------------------------------------------------------------------------
```

        Line 6 is the <u>REG</u> record, which tells the program which Coale-Demeny model life
table region to use. This information is used for estimating life tables, patterns of
change in life tables, and separation factors. In this case, the value "1" in column
20 indicates the Coale-Demeny west model region will be used.

        Line 7 is the <u>TOT</u> record, which tells the program that the projection is for the
total country (or other unit).

        Line 8 contains a comment, since it starts with an asterisk (*) in column 1.
One or more comment lines in this location normally would be used to document the
source of the input population data.

```
--------------------------------------------------------------------------------
Line *        10        20        30        40        50        60        70        80
---- *--------|---------|---------|---------|---------|---------|---------|---------|
9.   POP M51985                156218.
10.      722278    601552    531057    613793    703468    654624    531398    416520
11.      328363    270353    213639    166875    121324     80000     40000     20000
12.       10000
13.  POP F51985                155191.
14.      718820    599948    525649    476192    456479    413302    343960    278834
15.      225361    187277    146269    107610     73955    100000     50000     25000
16.       12500
--------------------------------------------------------------------------------
```

        Line 9 contains a <u>POP</u> record, which indicates population input. On this first
<u>POP</u> record the "M" in column 5 indicates data for males, and the "5" in column 6
indicates data in 5-year age groups. The year "1985" in columns 7-10 tells the
program that the following data are for the year 1985. This year is therefore the
base year of the projection. The figure "156218." in columns 24-30 is the male
population under age 1. This figure is used to improve the splitting of the
population in 5-year age groups into single years of age.

        Lines 10-12 contain the male population in 5-year age groups: starting with the
figure "722278" on line 10 for the population ages 0-4 and ending with the figure
"10000" on line 12 for the population ages 80 years and over. Lines 13-16 contain the
corresponding population data for females.

```
      ----------------------------------------------------------------------------------
      Line *      10        20        30        40        50        60        70        80
      ---- *--------|---------|---------|---------|---------|---------|---------|---------|
      17.  ********************************************************************************
      18.  * FIRST LIFE TABLE PRE-DATES BASE YEAR OF PROJECTION
      19.  MX  M51980
      20.        .09828    .00845    .00157    .00124    .00273    .00463    .00716    .00943
      21.        .01237    .01548    .02073    .02513    .03339    .03982    .05000    .06000
      22.        .07000    .08000
      23.  MX  F51980
      24.        .09359    .00836    .00138    .00105    .00180    .00264    .00372    .00499
      25.        .00665    .00829    .01118    .01347    .01940    .02478    .03000    .04000
      26.        .05000    .06000
      ----------------------------------------------------------------------------------
```

Line 17 is another comment line. In this case it serves to separate the
population data from the mortality data that follow. A similar purpose is served by
the comment records in lines 40, 47, and 57, while lines 18, 48, and 58 contain
comments about the data.

Line 19 is an MX record, which signals input of age-sex-specific central death
rates. As with the POP record, this record contains indicators as to the sex (male),
age grouping (5-year age groups), and year (1980). As the comment on line 18 notes,
these death rates pertain to a year prior to the base year of the projection. In this
case, these rates for 1980 will be used to determine life tables for 1985 and 1990
(see lines 27-30). One difference between the MX input data and the POP input data is
that the MX input data by 5-year age groups are always input as ages under 1, ages 1-
4, then 5-year age groups. On the MX record, the age code of "5" means the same as an
age format code of "4." Lines 20-22 contain the input central death rates by age for
males. Lines 23-26 contain the MX record and corresponding data for females.

```
      ----------------------------------------------------------------------------------
      Line *      10        20        30        40        50        60        70        80
      ---- *--------|---------|---------|---------|---------|---------|---------|---------|
      27.  MXM M 1985    62.06
      28.  MXM F 1985    67.61
      29.  MXM M 1990    64.00
      30.  MXM F 1990    70.00
      31.  * ULTIMATE LIFE TABLE
      32.  MX  M 2100      .12      1.30
      33.      .004702   .000286   .0000672  .0002887  .0005264  .0007616  .0006788  .0007806
      34.      .0011155  .0016384  .0027132  .0042289  .0063520  .0098638  .0156264  .0253448
      35.      .0423668  .0913791
      36.  MX  F 2100      .12      1.30
      37.      .003934   .000296   .0000862  .0001298  .0001810  .0002428  .0003019  .0004275
      38.      .0006692  .0010214  .0016147  .0024752  .0036087  .0056070  .0091217  .0156613
      39.      .0287332  .0685220
      40.  ********************************************************************************
      ----------------------------------------------------------------------------------
```

Line 27 is an MXM record, which indicates the user wishes to have a life table
generated with a given life expectancy at birth. In this case, a life expectancy of
62.06 for males in 1985 is specified. Line 28 contains the corresponding life
expectancy for females in 1985, and lines 29 and 30 contain life expectancy data for
1990. Since life tables are being provided for an earlier (1980) and later (2100)
year than designated in these MXM records, the life tables for the years specified
(1985 and 1990) will be estimated by linearly interpolating between the logarithms of
the $_nm_x$ values from the surrounding life tables in order to obtain the desired life
expectancy.

```
-------------------------------------------------------------------------------------
Line *        10        20        30        40        50        60        70        80
---- *--------|---------|---------|---------|---------|---------|---------|---------|
41.  ASFR 51985
42.       0.090     0.240     0.280     0.224     0.140     0.100     0.045
43.  TFR   1985     3.940
44.  ASFR 52010
45.       0.090     0.240     0.240     0.180     0.103     0.066     0.028
46.  TFR   2010     2.955
47.  *******************************************************************************
-------------------------------------------------------------------------------------
```

Line 41 is an <u>ASFR</u> record, which informs the program that age-specific fertility rates are being entered. In this case, the data are for 1985 and are in 5-year age groups. By default, the first age group of fertility data is assumed to be 15-19, but the age group 10-14 can be specified if desired (see page 59). Line 42 contains the ASFR's for 1985.

Line 43 contains a <u>TFR</u> record, which inputs a desired level of the total fertility rate (TFR). In this case, since it is also for the year 1985, it will be used to adjust the fertility rates specified in line 42 to obtain the TFR of 3.940 specified in columns 16-20 of line 43. In other situations, the <u>TFR</u> record will cause the program to adjust ASFR's for another year or to interpolate between sets of ASFR's. Lines 44-46 contain the same sequence of records for the year 2010. Since no estimates are given for the projection years 1986-1990, ASFR's for these years will be estimated by linear interpolation between the inputs for 1985 and 2010.

```
-------------------------------------------------------------------------------------
Line *        10        20        30        40        50        60        70        80
---- *--------|---------|---------|---------|---------|---------|---------|---------|
48.  * MIGRATION GIVEN FOR ONE YEAR WILL BE HELD CONSTANT FOR THE WHOLE PROJECTION
49.  MIGNM51987
50.      -21983    -21983    -19567     11830     25799     -2334     -8310     -7885
51.       -7786     -6503     -4774     -3349     -2810      -800      -400      -200
52.        -100
53.  MIGNF51987
54.      -21986    -21986    -20547    -14805     -5556     -7095     -6746     -4571
55.       -4293     -3749     -3639     -4101     -4104     -1000      -500      -250
56.        -125
57.  *******************************************************************************
-------------------------------------------------------------------------------------
```

Line 48 contains a comment about the migration data.

Line 49 contains a <u>MIGN</u> record, which indicates the input of net numbers of international migrants. As the note in line 48 indicates, when only one input for a component exists, it will be held constant throughout the projection. This means that the year specified on the <u>MIGN</u> record has no impact on the results of the projection, specifying the year as 1892 or 2133 would obtain the same results. However, it is useful to put a meaningful date on the parameter record, either the base year or the year for which it is an actual estimate. The data in this example are negative, representing net out-migration, for all groups except men ages 15-24.

```
--------------------------------------------------------------------------------
Line *         10        20        30        40        50        60        70        80
---- *--------|---------|---------|---------|---------|---------|---------|---------|
58.  * FULL-PAGE OUTPUT, AND LIFE TABLES FOR 1985 AND 1990 ONLY
59.  OUTP  1985         5         1990
60.  OMX   1985         5         1990
61.  END
--------------------------------------------------------------------------------
```

   Line 58 contains a comment about the output options selected in lines 59 and 60.
Line 59 is an <u>OUTP</u> record, instructing the program to produce detailed output. The
"1985" in columns 7-10 indicates that this output should start in 1985, the "5" in
column 20 indicates the output should be produced every 5 years, and the "1990" in
columns 27-30 tells the program to stop printing this output after 1990. Since this
projection starts in 1985 and ends in 1990, this record would result in output only
for the years 1985 and 1990. This output record would produce output on population,
vital rates, and migration (see parts 3.2.2, 3.2.3, and 3.2.4, pages 19-21).

   Line 60 contains an <u>OMX</u> record, which instructs the program to produce output of
age-specific central death rates ($_nm_x$ values). In this case, the output will be life
tables by sex, for the years 1985 and 1990. Sample life table output is presented in
part 3.2.5, page 22.

   Line 61 is an <u>END</u> record, which signals the end of the projection inputs.

3.2 Sample Output

3.2.1 Summary Tables 1 and 2

RUP always produces summary tables 1 and 2 for all years of the projection. These tables allow the user to check that assumptions about fertility and mortality were properly implemented and that the other measures are within expected limits.

S U M M A R Y   T A B L E   1 : T O T A L   10/31/1990 16:20

RUPTSTA--TOTAL COUNTRY ONLY

| | | EXPON. GROWTH RATE | GROWTH RATE | ------------------ C A L E N D A R   Y E A R   D A T A -------- | | | NET INTERNATIONAL ---------------- | |
YEAR	MIDYEAR POPULATION	(%)	(%)	BIRTHS	CBR	DEATHS	CDR	MIGRANTS	RATE
1985	10,766,400		.114	292,373	27.16	84,016	7.80	-196,076	-18.21
		.120							
1986	10,779,326		.126	291,159	27.01	81,445	7.56	-196,142	-18.20
		.121							
1987	10,792,325		.115	289,359	26.81	80,723	7.48	-196,208	-18.18
		.107							
1988	10,803,881		.099	287,018	26.57	80,126	7.42	-196,208	-18.16
		.089							
1989	10,813,449		.078	284,200	26.28	79,538	7.36	-196,208	-18.14
		.066							
1990	10,820,583		.054	280,970	25.97	78,949	7.30	-196,208	-18.13

S U M M A R Y   T A B L E   2 : T O T A L   10/31/1990 16:20

RUPTSTA--TOTAL COUNTRY ONLY

| | -EXPECTATION OF LIFE AT BIRTH- --BOTH-- | | | -INFANT MORTALITY RATE (PER 1,000)- ----BOTH--- | | | | |
YEAR	--SEXES--	--MALE--	-FEMALE--	----SEXES--	--MALE--	---FEMALE---	TFR(5)	TFR(1)
1985	64.81	62.06	67.61	56.7	50.6	62.8	3.9400	3.9400
1986	65.23	62.44	68.08	54.9	49.2	60.8	3.9006	3.9006
1987	65.66	62.82	68.55	53.1	47.7	58.7	3.8612	3.8612
1988	66.09	63.21	69.03	51.4	46.3	56.6	3.8218	3.8218
1989	66.53	63.60	69.51	49.6	44.8	54.4	3.7824	3.7824
1990	66.97	64.00	70.00	47.8	43.4	52.3	3.7430	3.7430

3.2.2 Population Output

        The population output (part of the detailed output produced when the <u>OUTP</u> record
is included) gives a comprehensive overview of the population by age and sex. Further
detail (in the form of population data by single years of age) can be obtained by
including an 'OPOP 1' record in the input (see Section 3.2.6, page 23 for sample
single-year population output).

DATA FOR THE YEAR 1985 : T O T A L   10/31/1990 16:20

RUPTSTA--TOTAL COUNTRY ONLY

POPULATION BY AGE AND SEX, AND SELECTED DERIVED MEASURES

AGE	BOTH SEXES	MALE	FEMALE	BOTH SEXES	MALE	FEMALE	SEX RATIO	AGE
	MIDYEAR POPULATION			PERCENT DISTRIBUTION				
ALL AGES	10,766,400	6,025,244	4,741,156	100.0	100.0	100.0	127.1	ALL AGES
0- 4	1,441,098	722,278	718,820	13.4	12.0	15.2	100.5	0- 4
5- 9	1,201,500	601,552	599,948	11.2	10.0	12.7	100.3	5- 9
10-14	1,056,706	531,057	525,649	9.8	8.8	11.1	101.0	10-14
15-19	1,089,985	613,793	476,192	10.1	10.2	10.0	128.9	15-19
20-24	1,159,947	703,468	456,479	10.8	11.7	9.6	154.1	20-24
25-29	1,067,926	654,624	413,302	9.9	10.9	8.7	158.4	25-29
30-34	875,358	531,398	343,960	8.1	8.8	7.3	154.5	30-34
35-39	695,354	416,520	278,834	6.5	6.9	5.9	149.4	35-39
40-44	553,724	328,363	225,361	5.1	5.4	4.8	145.7	40-44
45-49	457,630	270,353	187,277	4.3	4.5	4.0	144.4	45-49
50-54	359,908	213,639	146,269	3.3	3.5	3.1	146.1	50-54
55-59	274,485	166,875	107,610	2.5	2.8	2.3	155.1	55-59
60-64	195,279	121,324	73,955	1.8	2.0	1.6	164.1	60-64
65-69	180,000	80,000	100,000	1.7	1.3	2.1	80.0	65-69
70-74	90,000	40,000	50,000	.8	.7	1.1	80.0	70-74
75-79	45,000	20,000	25,000	.4	.3	.5	80.0	75-79
80+	22,500	10,000	12,500	.2	.2	.3	80.0	80+

SPECIAL AGE GROUPS

AGE	BOTH SEXES	MALE	FEMALE	BOTH SEXES	MALE	FEMALE	SEX RATIO	AGE
0	311,409	156,218	155,191	2.9	2.6	3.3	100.7	0
1- 4	1,129,689	566,060	563,629	10.5	9.4	11.9	100.4	1- 4
0-14	3,699,304	1,854,887	1,844,417	34.4	30.8	38.9	100.6	0-14
15-24	2,249,932	1,317,261	932,671	20.9	21.9	19.7	141.2	15-24
15-44	5,442,294	3,248,166	2,194,128	50.5	53.9	46.3	148.0	15-44
15-49	5,899,924	3,518,519	2,381,405	54.8	58.4	50.2	147.7	15-49
15-64	6,729,596	4,020,357	2,709,239	62.5	66.7	57.1	148.4	15-64
50-64	829,672	501,838	327,834	7.7	8.3	6.9	153.1	50-64
55+	807,264	438,199	369,065	7.5	7.3	7.8	118.7	55+
65+	337,500	150,000	187,500	3.1	2.5	4.0	80.0	65+
75+	67,500	30,000	37,500	.6	.5	.8	80.0	75+

MEDIAN AGE   22.6   23.9   20.5

DEPENDENCY RATIOS: 100X(DEPENDENT AGES)/(AGES 15-64)
   (0-14)+(65+)   60.0   49.9   75.0
   (0-14)   55.0   46.1   68.1
   (65+)   5.0   3.7   6.9

3.2.3 Vital Rates Output

        The detailed vital rates output is produced as part of the detailed output when
the <u>OUTP</u> record (page 75) is included in the input). This output provides additional
information not found in summary tables 1 and 2, in particular, presenting the
components of growth, by sex, and fertility data, by age of mother.

```
DATA FOR THE YEAR 1985 : T O T A L                              10/31/1990 16:20

RUPTSTA--TOTAL COUNTRY ONLY

VITAL RATE SUMMARY
(RATES PER 1,000 POPULATION, EXCEPT WHERE NOTED)
---------------------------------
ITEM                     RATE
---------------------------------
CBR                      27.16
CDR                       7.80
RNI (%)                  1.935
NET MIGRATION RATE      -18.21
GROWTH RATE (%)           .114
=================================

COMPONENTS OF POPULATION GROWTH BY SEX
--------------------------------------------------------
                    BOTH SEXES      MALE       FEMALE
--------------------------------------------------------
BIRTHS                 292,373    147,634      144,739
DEATHS                  84,016     49,512       34,504
NATURAL INCREASE       208,357     98,122      110,235
NET MIGRANTS          -196,076    -71,107     -124,969
POPULATION CHANGE       12,281     27,015      -14,734
========================================================

FERTILITY MEASURES
-------------------------------
AGE         ASFR        BIRTHS
-------------------------------
15-19        63.4        30,180
20-24       169.0        77,149
25-29       197.2        81,493
30-34       157.7        54,257
35-39        98.6        27,489
40-44        70.4        15,870
45-49        31.7         5,935

TFR        3.9400
=================================

MORTALITY MEASURES
------------------------------------------------------------------
ITEM                            BOTH SEXES     MALE     FEMALE
------------------------------------------------------------------
EXPECTATION OF LIFE AT BIRTH         64.81    62.06      67.61
INFANT MORTALITY RATE                56.67    50.61      62.85
INFANT DEATHS                        18,418    8,211     10,207
==================================================================
```

<u>3.2.4 Migration Output</u>

        The detailed migration output is produced as part of the detailed output when
the input includes an <u>OUTP</u> record (see page 75) and international or internal
migration data. This output presents data on net numbers of migrants and net
migration rates, by age and sex. For subarea projections with internal migration
(<u>RUMN</u> or <u>RUMR</u> records), a panel is produced showing net internal migration by age and
sex.

DATA FOR THE YEAR 1985 : T O T A L   10/31/1990 16:20

RUPTSTA--TOTAL COUNTRY ONLY

NET MIGRATION MEASURES BY AGE AND SEX
(RATES PER 1,000 POPULATION)
```
--------------------------------------------------------------------------------
        -------NET NUMBER OF MIGRANTS-------   -----NET MIGRATION RATE-----
AGE      BOTH SEXES      MALE       FEMALE   BOTH SEXES     MALE     FEMALE   AGE
--------------------------------------------------------------------------------
NET INTERNATIONAL MIGRATION

ALL AGES    -196,076     -71,107    -124,969      -18.2     -11.8     -26.4  ALL AGES

 0- 4       -43,939     -21,968     -21,971      -30.5     -30.4     -30.6    0- 4
 5- 9       -43,941     -21,969     -21,972      -36.6     -36.5     -36.6    5- 9
10-14       -40,086     -19,553     -20,533      -37.9     -36.8     -39.1   10-14
15-19        -2,973      11,822     -14,795       -2.7      19.3     -31.1   15-19
20-24        20,229      25,781      -5,552       17.4      36.6     -12.2   20-24
25-29        -9,422      -2,332      -7,090       -8.8      -3.6     -17.2   25-29
30-34       -15,047      -8,305      -6,742      -17.2     -15.6     -19.6   30-34
35-39       -12,447      -7,879      -4,568      -17.9     -18.9     -16.4   35-39
40-44       -12,071      -7,781      -4,290      -21.8     -23.7     -19.0   40-44
45-49       -10,245      -6,499      -3,746      -22.4     -24.0     -20.0   45-49
50-54        -8,407      -4,770      -3,637      -23.4     -22.3     -24.9   50-54
55-59        -7,445      -3,347      -4,098      -27.1     -20.1     -38.1   55-59
60-64        -6,909      -2,808      -4,101      -35.4     -23.1     -55.5   60-64
65-69        -1,800        -800      -1,000      -10.0     -10.0     -10.0   65-69
70-74          -899        -400        -499      -10.0     -10.0     -10.0   70-74
75-79          -449        -199        -250      -10.0     -10.0     -10.0   75-79
 80+           -225        -100        -125      -10.0     -10.0     -10.0    80+
================================================================================
```

Life table output is produced when an <u>OMX</u> record (see page 75) is included in the input. The life table output allows the user to check on how the program is estimating mortality by age and to examine changes in age-specific mortality measures over time.

```
DATA FOR THE YEAR 1985 : T O T A L
10/31/1990 16:20

RUPTSTA--TOTAL COUNTRY ONLY
                ABRIDGED LIFE TABLE FOR MALE

AGE    Q(X)    D(X)    M(X)    1(X)     L(X)     S(X)      T(X)     E(X)

  0    .05061   5061.  .05256 100000.   96298.  .96298 6206009.  62.06
  1    .01653   1569.  .00418  94939.  375601.  .94380 6109711.  64.35
  5    .00409    382.  .00082  93370.  465892.  .98727 5734110.  61.41
 10    .00458    426.  .00092  92987.  463871.  .99566 5268219.  56.66
 15    .00968    896.  .00195  92561.  460566.  .99288 4804348.  51.90
 20    .01584   1452.  .00319  91665.  454696.  .98726 4343782.  47.39
 25    .02180   1967.  .00441  90213.  446150.  .98120 3889085.  43.11
 30    .02784   2456.  .00565  88247.  435093.  .97522 3442935.  39.01
 35    .03699   3173.  .00754  85790.  421018.  .96765 3007842.  35.06
 40    .04758   3931.  .00975  82617.  403257.  .95781 2586823.  31.31
 45    .06594   5189.  .01364  78686.  380457.  .94346 2183566.  27.75
 50    .08343   6132.  .01741  73497.  352156.  .92561 1803110.  24.53
 55    .11199   7544.  .02373  67365.  317967.  .90292 1450954.  21.54
 60    .13900   8315.  .02988  59821.  278319.  .87531 1132987.  18.94
 65    .17914   9227.  .03935  51506.  234465.  .84243  854668.  16.59
 70    .22319   9436.  .05024  42280.  187808.  .80100  620203.  14.67
 75    .27260   8953.  .06312  32843.  141834.  .75521  432395.  13.17
 80   1.00000  23890.  .08222  23890.  290561.  .67198  290561.  12.16
```

$S(0) = L(0) / 1(0)$
$S(1) = 5L(5) / 5*1(0)$
$S(X) = 5L(X) / 5L(X-5)$
$S(80) = L(80) / T(75)$

SINGLE YEAR LIFE TABLE VALUES FOR AGES UNDER 5 YEARS

```
AGE    Q(X)    D(X)    M(X)    1(X)     L(X)     S(X)      T(X)     E(X)

  0    .05061   5061.  .05256 100000.   96298.  .96298 6206009.  62.06
  1    .00836    794.  .00839  94939.   94542.  .98177 6109711.  64.35
  2    .00391    368.  .00391  94145.   93961.  .99386 6015169.  63.89
  3    .00271    254.  .00271  93778.   93650.  .99669 5921207.  63.14
  4    .00165    154.  .00165  93523.   93446.  .99782 5827557.  62.31
```

$S(0) = L(0) / 1(0)$
$S(X) = L(X) / L(X-1)$

SEPARATION FACTOR FOR AGE 0= .2685
SEPARATION FACTOR FOR AGES 1-4= 1.3524

3.2.6 Single Year Population Output

Single year population output is produced by including an <u>OPOP</u> record (see page 75) specifying an age grouping of 1 (single years). For example, the following input would generate this table:

OPOP 1 1990

DATA FOR THE YEAR 1990 : T O T A L   12/04/1990 08:47

RUPA--TOTAL COUNTRY ONLY TEST ALL OUTPUTS

| AGE | --M I D Y E A R   P O P U L A T I O N--- | | | AGE | --M I D Y E A R   P O P U L A T I O N--- | | |
	-BOTH SEXES-	----MALE----	---FEMALE---		-BOTH SEXES-	----MALE----	---FEMALE---
ALL AGES	10820583.	6153098.	4667485.				
0	268,277	135,886	132,391	40	135,574	80,844	54,730
1	257,319	130,754	126,565	41	128,525	76,317	52,208
2	248,843	126,684	122,159	42	121,823	72,042	49,781
3	240,602	122,678	117,924	43	115,542	68,068	47,474
4	231,330	118,208	113,122	44	109,653	64,376	45,277
5	257,238	129,872	127,366	45	104,048	60,903	43,145
6	251,308	126,534	124,774	46	98,796	57,687	41,109
7	241,055	120,924	120,131	47	94,124	54,836	39,288
8	230,719	115,656	115,063	48	90,120	52,409	37,711
9	220,953	110,837	110,116	49	86,621	50,300	36,321
10	212,140	106,570	105,570	50	83,497	48,481	35,016
11	204,174	102,715	101,459	51	80,449	46,777	33,672
12	196,859	99,034	97,825	52	77,218	44,978	32,240
13	190,047	95,413	94,634	53	73,635	42,980	30,655
14	183,467	91,701	91,766	54	69,826	40,864	28,962
15	180,538	90,858	89,680	55	65,910	38,714	27,196
16	182,204	93,979	88,225	56	62,070	36,661	25,409
17	186,104	99,210	86,894	57	58,399	34,743	23,656
18	192,736	107,126	85,610	58	54,945	33,003	21,942
19	201,489	117,065	84,424	59	51,671	31,397	20,274
20	209,519	125,856	83,663	60	48,628	29,806	18,822
21	216,276	132,760	83,516	61	45,649	28,163	17,486
22	223,761	139,926	83,835	62	42,503	26,515	15,988
23	231,856	147,122	84,734	63	39,067	24,821	14,246
24	240,146	154,122	86,024	64	35,542	23,110	12,432
25	243,483	157,075	86,408	65	32,253	21,550	10,703
26	240,917	155,343	85,574	66	29,768	20,174	9,594
27	236,311	151,883	84,428	67	28,416	18,857	9,559
28	228,902	146,113	82,789	68	28,560	17,607	10,953
29	219,255	138,501	80,754	69	29,678	16,408	13,270
30	211,193	132,371	78,822	70	30,961	15,158	15,803
31	205,245	128,204	77,041	71	31,357	13,804	17,553
32	198,191	123,281	74,910	72	30,470	12,414	18,056
33	190,061	117,679	72,382	73	27,769	10,955	16,814
34	181,121	111,563	69,558	74	23,838	9,481	14,357
35	172,346	105,583	66,763	75	19,559	8,056	11,503
36	164,197	100,038	64,159	76	15,702	6,752	8,950
37	156,351	94,711	61,640	77	12,755	5,631	7,124
38	149,123	89,832	59,291	78	10,798	4,710	6,088
39	142,409	85,325	57,084	79	9,594	3,968	5,626
				80+	47,205	19,786	27,419

3.2.7 Output of Deaths by Age

        The output of deaths by age is produced by including the <u>ODTH</u> record in the
input file (see page 75). This output is useful for comparing the results with
registered data, if available, or, in general, to examine the distribution of deaths
by age.

DATA FOR THE YEAR 1985 : T O T A L
12/04/1990 08:47

 RUPA--TOTAL COUNTRY ONLY TEST ALL OUTPUTS

 DEATHS BY AGE AND SEX

AGE	BOTH SEXES	MALE	FEMALE
ALL AGES	84,016	49,512	34,504
0	18,418	8,211	10,207
1	2,979	1,262	1,717
2	1,324	563	761
3	865	376	489
4	561	219	342
5- 9	1,102	494	608
10-14	926	488	438
15-19	1,858	1,194	664
20-24	3,170	2,246	924
25-29	4,047	2,885	1,162
30-34	4,306	3,000	1,306
35-39	4,576	3,140	1,436
40-44	4,681	3,201	1,480
45-49	5,375	3,687	1,688
50-54	5,351	3,720	1,631
55-59	5,691	3,959	1,732
60-64	5,178	3,625	1,553
65-69	5,776	3,148	2,628
70-74	3,811	2,010	1,801
75-79	2,438	1,262	1,176
80+	1,583	822	761

4. RUP Input Summary

```
*--------------------------------------------------------------------------:--------------------------
*  56  10        20        30        40        50        60        70        80: Description
*---||---|---------|---------|---------|---------|---------|---------|---------|:--------------------------
EDIT                                                                         : Scan inputs, do not
*--------|---------|---------|---------|---------|---------|---------|---------|:  project.
TITL          ntitl                                                          : Title for labeling output.
title lines                                                                  :
*--------|---------|---------|---------|---------|---------|---------|---------|:
N5            nage5                                                          : # of 5-year age groups.
N             nage1                                                          : # of single ages.
*--------|---------|---------|---------|---------|---------|---------|---------|:
PROJ  yend                                                                   : Final year of projection.
*--------|---------|---------|---------|---------|---------|---------|---------|:
SXRB  year       Sxrb                                                        : Sex ratio at birth.
*--------|---------|---------|---------|---------|---------|---------|---------|:
SPAG          nspag                                                          : Special age groups.
   L1   U1   L2   U2   L3   U3   L4   U4   L5   U5   L6   U6   L7   U7        :
*--------|---------|---------|---------|---------|---------|---------|---------|:
REG           region                                                        : Coale-Demeny region
*--------|---------|---------|---------|---------|---------|---------|---------|:
AREA                                                                         : Area name (e.g., URBAN).
area name                                                                    :
*--------|---------|---------|---------|---------|---------|---------|---------|:
CODE          arnum                                                          : Code for current area.
*--------|---------|---------|---------|---------|---------|---------|---------|:
TOT                                                                          : Total projection.
*--------|---------|---------|---------|---------|---------|---------|---------|:
POP sayear       na        p0      tpop                                      : Base population data.
     pop 1     pop 2     pop 3     pop 4     pop 5  etc.                      :
*--------|---------|---------|---------|---------|---------|---------|---------|:
MX   sayear     sep0      sep1       na       adj                            : Input age-specific central
     mx 1      mx 2      mx 3      mx 4      mx 5  etc.                       :  death rates.
QX   sayear     sep0      sep1       na                                      : Input age-specific      .
       qx 1      qx 2      qx 3      qx 4      qx 5  etc.                     :  probabilities of dying.
*--------|---------|---------|---------|---------|---------|---------|---------|:
MLT sayear       e0                                                          : Model life table.
MXM s year       e0       sep0                                              : Modify mx values to get
*--------|---------|---------|---------|---------|---------|---------|---------|:  desired e0.
* note that the SEP0 record, if desired, must follow the DTH record          : Input deaths by age and
DTH s year       na     bsdth     mdth      fdth                            :  sex.
SEP0          sep0m     sep0f                                                : Separation factors, age 0.
  age   wid    maled     femd                                               :
       or                                                                    :
  age   wid    bsexd                                                         :
*--------|---------|---------|---------|---------|---------|---------|---------|:
*        10        20        30        40        50        60        70        80:
*--------------------------------------------------------------------------:
```

4. RUP Input Summary (continued)

```
*----------------------------------------------------------------------:--------------------------
*   56 10       20        30        40        50        60        70        80: Description
*---||---|---------|---------|---------|---------|---------|---------|---------|:--------------------------
ASFR ayear       ia                                                         : Input age-specific
      asfr 1    asfr 2    asfr 3    asfr 4    asfr 5  etc.                   :  fertility rates.
*--------|---------|---------|---------|---------|---------|---------|---------|:
TFR   year      tfr                                                         : Input total fertility rate.
*--------|---------|---------|---------|---------|---------|---------|---------|:
BTH   year       na     bsbth      mbth      fbth                           : Input births by age.
  age  wid     bsexb                                                        :
*--------|---------|---------|---------|---------|---------|---------|---------|:
MIGNsayear       na                                                        : Input net numbers of
  migs 1    migs 2    migs 3    migs 4    migs 5  etc.                       :  international migrants.
MIGRsayear       na                                                        : Input net international
  rate 1    rate 2    rate 3    rate 4    rate 5  etc.                       :  migration rates.
RUMNsayear       na                                                        : Input net numbers of
   migs 1    migs 2    migs 3    migs 4    migs 5  etc.                      :  internal migrants.
RUMRsayear       na                                                        : Input net internal
    rate 1    rate 2    rate 3    rate 4    rate 5  etc.                     :  migration rates.
*--------|---------|---------|---------|---------|---------|---------|---------|:
OUTPsayear       frq      yrf      dsrn                                     : Detailed output.
OPOPsayear       frq      yrf      dsrn                                     : Population output.
OMX sayear       frq      yrf      dsrn                                     : Mx or life table output.
ODTHsayear       frq      yrf      dsrn                                     : Output deaths by age/sex.
OBTHsayear       frq      yrf      dsrn                                     : Output births by age.
*--------|---------|---------|---------|---------|---------|---------|---------|:
END                                                                        : End of projection.
*--------|---------|---------|---------|---------|---------|---------|---------|:
NOTE            nn                                                          : Notes to describe inputs,
notes go here ..                                                           :  etc.
*--------|---------|---------|---------|---------|---------|---------|---------|:
* comment                                                                  : Comments on inputs, etc.
*--------|---------|---------|---------|---------|---------|---------|---------|:
*      10        20        30        40        50        60        70        80:
*----------------------------------------------------------------------:
```

4. RUP Input Summary (continued)
(symbol definitions)

Symbol	Definition
a	(column 6) age grouping 0 or blank = default 1　　　　= single years of age 4　　　　= ages 0, 1-4, 5-9, 10-14, 　　　　　　etc. 5　　　　= ages 0-4, 5-9, 10-14, etc. 9　　　　= total, all ages (MIGN and 　　　　　　RUMN only)
adj	if > 0, adjust mx for ages 1, 2, 3, 4
age	lower limit of age group
arnum	area number
bsbth	total births both sexes
bsdth	total deaths both sexes
bsexb	both sexes births
bsexd	both sexes deaths
dsrn	data set reference number
e0	life expectancy at birth
fbth	total births female
fdth	total deaths female
femd	female deaths
frq	frequency of output
ia	initial age of ASFR data
ln	lower age, special group n
maled	male deaths
mbth	total births male
mdth	total deaths male
na	number of ages of data
nage1	# of single ages to use in the projection
nage5	# of 5-year ages to use in the projection
nn	number of note records
nspag	# of special ages
ntitl	number of TITL records
p0	population under age 1

Symbol	Definition
region	Coale-Demeny model life table region to be used, if needed 　　1 = West 　　2 = North 　　3 = East 　　4 = South
s	(column 5) sex code 0 or blank = default B = Both sexes E = Each sex, (male, then female) F = Female M = Male
sep0	separation factor age 0
sep0f	female separation factor age 0
sep0m	male separation factor age 0
sep1	separation factor ages 1-4
sxrb	sex ratio at birth (male/female)
tfr	total fertility rate
tpop	total population
un	upper age, special group n
wid	width of age group
year	year to which data refer
yend	ending year of the projection
yrf	final year to print

<u>**B. Installation and Operation**</u>

<u>1. Installation</u>

See separate installation instructions.

<u>2. Operation</u>

See the separate RUPEX or RUPMENU documentation.

<u>a. Input File</u>

The RUP program will prompt you for the input file name. Any legal DOS file name
(including the drive and path) is permitted. If no drive or path is specified, the
default DOS drive and path will be used (usually the drive and path where the RUP.EXE
file is located). For best results, restrict the name to letters only, and use no
more than 7 letters for the filename since an 8th character in the name will be
replaced in the output files names (see page 29). For the input file extension, use
anything except .OUT, .IO1, or .IO2. [Note that the RUPMENU program expects the extension.IN]

The RUP program will notify you if it cannot find your input file. In this case,
you have the options either to stop the run or to re-enter the file name (e.g., if you
spelled it wrong or indicated the wrong drive and/or directory).

<u>b. Output Files</u>

The RUP program will use the first 7 characters of the name of the input file to
construct the output file names. If you specify a drive and/or path, they will be
retained as well. For example:

```
    ---------------------------------------------------------------
    Item                    Sample  1          Sample 2
    ---------------------------------------------------------------
    Input file              A:IRELAND.IN       C:\123\BOTSWANA.PRN
    Input listing           A:IRELAND.OUT      C:\123\BOTSWAN.OUT
    Table 1                 A:IRELAND1.OUT     C:\123\BOTSWAN1.OUT
    Table 2                 A:IRELAND2.OUT     C:\123\BOTSWAN2.OUT
    Full Page               A:IRELANDF.OUT     C:\123\BOTSWANF.OUT
    Intermediate 1          A:IRELAND.I01      C:\123\BOTSWAN.I01
    Intermediate 2          A:IRELAND.I02      C:\123\BOTSWAN.I02
    Population (OPOP)        A:IRELANDP.OUT     C:\123\BOTSWANP.OUT
    Mx output (OMX)         A:IRELANDM.OUT     C:\123\BOTSWANM.OUT
    Death output (ODTH)     A:IRELANDD.OUT     C:\123\BOTSWAND.OUT
    Birth output (OBTH)     A:IRELANDB.OUT     C:\123\BOTSWANB.OUT
    ---------------------------------------------------------------
```

The "input listing" file is the echo of the input file with any error messages,
etc.

The RUP program will notify you if it finds that the listing file already exists.
In this case, you can choose to overwrite the file (for example, if you are re-running
the program after correcting the input data). Due to the file name structure, the
program will give you a warning only for the listing file on the assumption that, if
you want to replace it, you will want to replace the others with the same name scheme.

While the program is running, it will display a summary of the projection on the
screen.

When the projections for all areas are completed successfully, the program will
display the message "Stop - Program terminated" and return to the DOS prompt.

The program produces error or warning messages if it detects problems with the
projection. An error message indicates a severe problem that prevents the program

from continuing. A warning indicates a potential problem that should be investigated.
When RUP detects an error or warning condition, it writes a message to the listing
file and the program will display the following messages at the end of the projection
(or when the error occurs):

CHECK OUTPUT LIST FILE FOR ERRORS/WARNINGS

*** NUMBER OF ERRORS/WARNINGS =   xx
FOR DETAILS, CHECK OUTPUT LISTING FILE file.OUT

If there was at least one severe error, the following message will also be displayed:

*** AT LEAST ONE SERIOUS ERROR WAS FOUND ***

   The first type of error is a problem with the input file. Check the message in the
input listing file and correct the error indicated. To check the input listing file,
you can use the RUPMENU program to view or print it.

   In other cases, the program does not detect an error in the input, but the program
cannot continue due to an error in the projection, or the program has detected a
situation which may produce unreliable results. The program may detect such an error
and print an error message, usually indicating a value outside of the expected range.
In this case, look at the listing file (as indicated above) and examine both your
input and the output that was produced to determine where and why the error may have
occurred. Focus on the last year of output printed and examine the input for the
following and subsequent years (e.g., MX records for an ultimate life table, if the
next mortality inputs are MXM records).

   In some situations, the RUP program will not detect any error, but the program
still cannot continue. This will generate a "run-time error" (e.g., division by
zero). In this case, you will have less information to work with (e.g., you will not
know whether the program was working with fertility or mortality input when the error
occurred). Again, examine all the outputs (input listing, summary tables, full-page
output) to determine the location of the data that caused the problem.

   Refer to Part H for a list of RUP error messages and suggestions for correcting
them.

   e. Printing

       See separate RUPEX or RUPMENU documentation.

C. Creating RUP Input Files

1.   Introduction

RUP input files can be created and modified in any program capable of reading, editing, and writing out ASCII files.   Text editors that are designed for use with ASCII files are the best. The easiest method is currently to use the editor built into the RUPMENU program (see separate documentation). For the RUPEX system, the notepad program can be used.

D. Documentation: RUP

1. General Structure of Input to RUP

As noted above, the input to RUP consists of three types of records: parameter records, data records, and comment records. This section will give a general description of these record types.

Parameter records serve three functions:

(1)   Describe certain aspects of the projection (e.g., the TOT record indicates that the records that follow apply to the total area projection).

(2)   Define parameters of the projection (e.g., the PROJ record designates the final year of the projection).

(3)   Introduce certain data records.

The parameter records follow a fixed format as described in Section 1.1.2, page 35. The parameter records recognized by the program are shown in table 1.

Data records contain data of a repetitive nature and allow for formats specific to the information they contain (e.g., character data for the title records and 10-column fields of numeric data for the base population by age and sex). Data records always immediately follow their associated parameter record. The formats of the data records are described in the section which describes the associated parameter record.

Comment records allow the user to document the source of input data, separate types of data, etc.

Table 1. RUP Parameter Records and Their Functions

Type | Function

TITL Precedes records with descriptive information to be printed
      on each page of output.

N5   Specifies the number of 5-year age groups to be used in the
      projection.

N   Specifies the number of single years of age to be used in
      the projection.

SPAG Specifies the special age groups for which population data
      are to be printed.

PROJ Specifies the final year of the projection.

REG   Specifies a Coale-Demeny model life table region.

SXRB Specifies the sex ratio at birth.

AREA Initiates input of parameter records which describe the
      projection for a particular area or group.

CODE Specifies a code number to be associated with a particular
      area or group. Including the code record causes the program to
      create the intermediate file.

TOT   Initiates input of parameter records which control the total
      population phase.

POP   Specifies the base year of the projection and precedes the
      base-year population data.

MX   Initiates input of age-sex-specific central death rates.

QX   Initiates input of age-sex-specific mortality rates.

MXM   Specifies a desired life expectancy at birth.

MLT   Specifies the life expectancy at birth of a Coale-Demeny
      model life table.

DTH   Specifies deaths by age and sex.

ASFR Initiates the input of age-specific fertility rates.

TFR   Specifies a desired level of the total fertility rate.

BTH   Specifies births by age of mother.

Table 1. RUP Parameter Records and Their Functions (Continued)

Type | Function

MIGN   Initiates the input of the net number of international
       migrants by age and sex.

MIGR   Initiates the input of age-sex-specific net international
       migration rates.

RUMN   Initiates the input of the net number of internal migrants,
       by age and sex.

RUMR   Initiates the input of age-sex-specific net internal
       migration rates.

OUTP   Controls full-page output.

OPOP   Controls special population output.

OMX   Controls age-sex-specific central death rate output.

OBTH   Controls output of births, by age of mother.

ODTH   Controls output of deaths, by age and sex.

END   Specifies the end of the projection inputs.

NOTE   Allows the inclusion of descriptive notes which are printed
       only as encountered during input.

EDIT   Allows scanning of parameter and data records without projecting.

    1.1 Parameter Records

        1.1.1 Parameter Record Order

     The parameter records and any associated data records must follow certain rules
regarding where they are located in the input to RUP. Table 2 shows the 11 order
groups where the parameter records are to be included and indicates whether or not the
records are required. The sequence of parameter records within the order groups is
not important as long as the appropriate number of data records for each parameter
record are included.

```
Table 2.  Parameter Record Order for RUP
----------------------------------------------------------------------
Phase | Order | Parameter Records*
----------------------------------------------------------------------
  0       1      (EDIT)

  0       2      TITL, [N5, N], PROJ, (SPAG), (REG), (SXRB)

  1       3      [AREA, TOT]

  1       4      (REG), (SXRB), (CODE), POP, {MX, QX, MLT}, (DTH), (MXM),
                 ASFR, (BTH), (TFR), ([MIGN, MIGR]), ([RUMN, RUMR])

  1       5      (OUTP, OMX, OPOP, ODTH)

 (2)     (6)     ([AREA, TOT])

 (2)     (7)     (REG), (SXRB), (CODE), POP, {MX, QX, MLT}, (DTH), (MXM),
                 ASFR, (BTH), (TFR), ([MIGN, MIGR]), ([RUMN, RUMR])

 (2)     (8)     (OUTP, OMX, OPOP, ODTH)

 (3)     (9)     ([TOT, AREA])

 (3)    (10)     (OUTP, OMX, OPOP, ODTH)

None     11      END
----------------------------------------------------------------------
```

* Symbols (where A and B represent parameter record names):

 A   Parameter record A is required in this location.

(A)   Parameter record A is optional in this location.

[A, B]   Choose only one parameter record, A or B.

{A, B}   Choose at least one parameter record, A or B or both.

Notes: The sequence of parameter records within a given order group is not important except for the DTH records. Each DTH record must: (1) have an MX, QX, MLT, or DTH record for the year prior to the year of death data, and (2) be followed by an MX, QX, or MLT record for a later date.

REG and SXRB must be specified in order 2 or order 4.

They must be specified in order group 7 if present.

The NOTE parameter record and associated notes or the * comment records can be placed at any location in the run where a parameter record is expected.

If only one or two phases are desired (selected from rural, urban, and total), do not include any of the records for the later phases (i.e., do not include records in orders 6-10 if only one phase is desired, or do not include records in orders 9 and 10 if only two phases are desired).

The TOT record can appear only once in a particular run, and the AREA records can appear only twice. Data for each component must be entered in chronological order. The components are: mortality (MX, QX, MXM, DTH, OR MLT input), fertility (ASFR, TFR, or BTH input), international migration (MIGN or MIGR input but not both), and internal migration (RUMN or RUMR, but not both. SXRB and BTH records must be in chronological order because they both can affect the sex ratio at birth.

<u>1.1.2 Parameter Record Format</u>

    In the following description of the various inputs to the program, the record
layout is as shown below for each parameter record:

```
*-------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
typesayear    value1    value2    value3    value4    value5
*--------|---------|---------|---------|---------|---------|---------|---------|
```

    The fields used for a particular parameter record are shown by the field name in
the record layout. The *type*, *s* (sex), *a* (age), and *year* fields are specified on many
parameter records. These fields are described generally in this section, and
exceptions to these rules are indicated later in the description of the specific
parameter records.

Record   Columns   Field   Definition
----
  1   1-4   *type*   Each record type is composed of 1 to 4 characters
                                   which are left-justified (i.e., they begin in column
                                   1). Table 1 contains a list of the valid parameter
                                   record types and a summary of their functions.

         5   *s*   The sex of the population data:
                                   M = Male
                                   F = Female
                                   E = Each sex (male, then female)
                                   B = Both sexes (not usually permitted)

         6   *a*   Age grouping of the data:
                                   0 or blank = default age grouping:
                                             1 if <u>N</u> record present
                                           5 if <u>N5</u> record present
                                 1 = Single years of age
                                 4 = Ages 0 (under 1), 1-4, 5-9, etc.
                                 5 = Ages 0-4, 5-9, etc.
                               9 = All ages (not usually permitted)

```
-------------------------------------------------------------------------
Record     Columns     Field     Definition
-------------------------------------------------------------------------
1          7-10        year      Year to which the data refer.  Remember that the
                                 fertility, mortality, and migration data for a
                                 particular year refer to the year centered on the
                                 date of the population data.  The year entered on a
                                 parameter record can be a year outside the projection
                                 period.  For example, a base life table (MX or QX
                                 input) can refer to a year prior to the beginning of
                                 the projection; or an "ultimate" life table can be
                                 input for a year after the final year of the
                                 projection, to be used for interpolating mortality
                                 data for intermediate years.  The year on the POP
                                 record defines the beginning of the projection
                                 period, and the year on the PROJ record defines the
                                 end of the projection period.
-------------------------------------------------------------------------
```

Additional information may be included on some parameter records. These values are coded in successive 10-column fields (*value1* through *value5* in the record layout above), starting with columns 11-20. These values should be right-justified. If a decimal point is required, this will be indicated in the description of the particular field on the parameter record.

1.2 Data Records

In many cases, the parameter record is used to describe the type of data that follows. The data records are usually composed of eight 10-column fields, columns 1-10 through 71-80. The proper number of data records must be included to satisfy the requirements specified on the parameter record. This will depend on

(1)   The number of age groups specified on the N5 or N record or on the parameter record.

(2)   The format of the data (i.e., whether the data are in single years or 5-year age groups).

When absolute numbers are being coded, they should be right-justified; and the decimal point need not be included. For rates, on the other hand, the decimal point must be specified. It is helpful to line up the rate values (whether right- or left-justified, or even centered) to make it easy to check the data for errors.

2. General Information Input Records

The records described in this section define parameters which generally remain in effect throughout all three phases of the projection (i.e., rural, urban, and total). These records must be included in the input to the first phase, unless the default options are desired.

2.1 The TITL Record: Description of the Projection

The TITL record is used to inform the program that one or more records will follow that contain descriptive information about the projection (e.g., the country, the source of the base data, the fertility assumptions).   Information on the title records will be printed on every page of output.

Layout for the TITL parameter record and associated data records:

```
*----------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
TITL          ntitl
title
*----------------------------------------------------------------------
```

Record	Columns	Field	Definition
1	1-4	TITL	The characters `TITL' in this field indicate that this is a TITL parameter record
	20	*ntitl*	Number of title records that follow. This number must be less than or equal to 7, and the sum of *ntitl* plus *nspag* (number of additional special age groups on the SPAG record, see page 41) must be less than or equal to 8. If *ntitl* is zero or blank, a value of 1 is assumed.
2	1-80	*title1*	Title record number 1.
...			...
ntitl+1	1-80	*titlen*	Title record number *ntitl*.

Example: Print a heading on each page of output
```
*----------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
TITL                2
EGYPT
LOW FERTILITY
*----------------------------------------------------------------------
```
The two lines:

EGYPT
LOW FERTILITY

will be printed at the top of each page.

2.2 The N5 Record: Number of 5-Year Age Groups

    The N5 record tells the program how many 5-year age groups of data to use in the
projection. The N5 record also informs the program that the default input format will
be 5-year age groups. One N5 or N record must be included in every projection.

    The program assumes that all input data are in *nage5* 5-year age groups, unless it
is told there are more age groups for a particular type of record (e.g, the POP
record) and/or the age grouping is different. However, the number of age groups used
and printed will be N5.

```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|--------|
N5              nage5
*------------------------------------------------------------------------------
```
```
------------------------------------------------------------------------------
Record    Columns    Field      Definition
------------------------------------------------------------------------------
1         1-4        N5         Indicates this is an N5 parameter record.

          19-20      nage5      The number of 5-year age groups from ages 0 to 4
                                years up to and including the last, open-ended age
                                group.  The value of nage5 must be in the range 11 to
                                21, corresponding to open-ended age groups of 50
                                years and over and 100 years and over, respectively.
------------------------------------------------------------------------------
```
Example: Specify the number of 5-year age groups
```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
N5              17
*------------------------------------------------------------------------------
```
There are 17 5-year age groups, from 0-4 to 80+.

2.3 The N Record: Number of Single Years of Age

The N parameter record tells the program how many single years of age of data to use in the projection. The N record also informs the program that the default input format will be single years of age.

```
*------------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|--------|--------|
N           nage1
*------------------------------------------------------------------------------
```

Record	Columns	Field	Definition
1	1-4	N	Indicates this is an N parameter record.
	18-20	*nage1*	The number of single-year age groups, from age 0 (under 1) up to and including the last, open-ended age group. The value of *nage1* must be in the range 51 to 101, corresponding to open-ended age groups of 50 years and over to 100 years and over, respectively.

Example: Specify the number of single years of age
```
*------------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
N           101
*------------------------------------------------------------------------------
```
The default age grouping is single years of age, and there are 101 ages, from 0 to 100+.

2.4 The PROJ Record: Final Projection Year

The PROJ record is used to indicate the final year of the projection. One PROJ record with a *yend* value greater than or equal to 0 is required for each run.

```
*------------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
PROJ  yend
*------------------------------------------------------------------------------
```

Record	Columns	Field	Definition
1	1-4	PROJ	Indicates this is a PROJ record.
	7-10	*yend*	Ending year of the projection.

Example: Specify the final year of the projection
```
*------------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
PROJ  1995
*------------------------------------------------------------------------------
```
The population should be projected to the year 1995.

2.5 The SXRB Record: Sex Ratio at Birth

The SXRB record provides the value of the sex ratio at birth.

```
*-----------------------------------------------------------------------------
*     10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
SXRB
*-----------------------------------------------------------------------------
-------------------------------------------------------------------------------
Record    Columns    Field     Definition
-------------------------------------------------------------------------------
1         1-4        SXRB      Indicates this is an SXRB record.
          7-10       year
          11-20      sxrb      Sex ratio at birth (number of male births per female
                               birth).  The value of sxrb must be in the range 0.9
                               to 1.15.  The decimal point must be included in the
                               input value.
-------------------------------------------------------------------------------
Example:  Specify the sex ratio at birth
*-----------------------------------------------------------------------------
*     10        20        30        40        50        60        70        80
*      |         |         |         |         |         |         |         |
SXRB           1.05
*-----------------------------------------------------------------------------
```
The sex ratio at birth is 1.05 males per female.

Since the urban and rural projections are done separately, a different sex ratio at birth can be specified for each area.

Alternatively, the sex ratio at birth is implied when births by sex are entered on the BTH record (see page 64). The value implied by a BTH record replaces the value on the SXRB record and remains in effect until another BTH record is reached.

Since the SXRB and BTH records both can determin the sex ratio at birth, the sequence of these records must be in chronological order. Thus, if BTH data are input by sex for several years and then you want to use a sex ratio at birth different from that implied by the last BTH input, the SXRB input must follow the last BTH input.

2.6 The SPAG Record: Special Age Groups

    The SPAG record allows the user to enter special age groups in addition to those
that are included automatically. Population in special age groups is printed along
with the population in 5-year age groups. Special age groups included automatically
are as follows:

```
0 (Under 1)
1-4
0-14
15-24
15-44
15-49
15-64
50-64
55+
65+
75+
*-----------------------------------------------------------------------------
*        10          20          30          40          50          60          70          80
*-------|---------|---------|---------|---------|---------|---------|---------|
SPAG          nspag
   l1    u1    l2    u2    l3    u3    l4    u4    l5    u5    l6    u6    l7    u7
   *-----------------------------------------------------------------------------
```

```
--------------------------------------------------------------------------
Record    Columns    Field    Definition
--------------------------------------------------------------------------
1         1-4        SPAG     Indicates a SPAG record.

          20         nspag    The number of special age groups.  This number must
                              be less than or equal to 7, and the sum of nspag plus
                              the number of title records (ntitl) must be less than
                              or equal to 8.

  2       1-5        l1       Lower limit of the first special age group *.

          6-10       u1       Upper limit of the first special age group *.

          11-15      l2       Lower limit of the second special age group *.

          16-20      u2       Upper limit of the second special age group *.
          ...                 ...
          61-65      l7       Lower limit of the seventh special age group *.

          66-70      u7       Upper limit of the seventh special age group *.

*         -                   Specify the ages in completed years (e.g., to specify the age
                              group  "under 15," code 0 as the lower limit and 14 as the
                              upper limit).
          -                   To specify a single year age group, code identical lower and
                              upper  limits.
          -                   If an age is entered that is greater than or equal to the
                              initial  age of the open-ended age group, the whole open-ended
                              age group  will be included.
          -                   A blank field will be read as zero (0).
          -                   Right-justify the age group limits in the 5-column fields.
--------------------------------------------------------------------------
```

The maximum number of additional special age groups that can be specified is seven
(7), but the number of special age groups plus the number of title records (see
page 37) must be less than or equal to eight (nspag + ntitl ≤ 8).

Example: Specify additional special age groups

```
*--------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
SPAG              7
   0    0    1    1    2    2    3    3    4    4    6   11   62  999
*--------------------------------------------------------------------------
```
The population in the age groups 0, 1, 2, 3, 4, 6-11, and 62 years and over will be
printed.

2.7 The REG Record: Coale-Demeny Model Life Table Region

The REG record is used to specify the Coale-Demeny model life table region to be used for (1) determining separation factors, (2) splitting mortality for ages 1-4, and/or (3) creating model life tables.

```
*------------------------------------------------------------------------------
*        10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
REG          region
*------------------------------------------------------------------------------
------------------------------------------------------------------------------
Record    Columns    Field    Definition
------------------------------------------------------------------------------
  1        1-3        REG      Indicates a REG record.

           20         region   The code for the Coale-Demeny model life table region
                               desired:
                                   1 = West
                                   2 = North
                                   3 = East
                                   4 = South
------------------------------------------------------------------------------
```
If no REG record is included, the west region will be used.

Example: Specify a Coale-Demeny model life table region
```
*------------------------------------------------------------------------------
*        10        20        30        40        50        60        70        80
*         |         |         |         |         |         |         |         |
REG          2
*------------------------------------------------------------------------------
```
The north region model should be used.

3. Area Selectors, Codes, and Intermediate Files

   When a two-region projection is desired, the user must indicate the names of the regions and the data for performing the projection for those areas. This is accomplished by the AREA and TOT records. Each AREA or TOT record signifies the beginning of data for a new area.

   The RUP program uses intermediate files to do aggregations (for example, it uses urban and rural data to get total country results). When the program is used to project the whole country's population, there is usually no need to create an intermediate file, since creating it (a) would slow down the program, and (b) may cause the program to run out of disk space and end prematurely.

   In addition to allowing two-area projections (e.g., rural and urban or total and rural), with the resulting total or residual, the intermediate files can also be used as input to the RUPAGG program. See separate documentation of the RUPAGG program.

   In order to address this situation, the RUP program creates the intermediate file only if it is explicitly instructed to do so by including a CODE record, usually inserted immediately after the AREA record (and area label data record) or TOT record.

3.1 The AREA Record: Area Selector

    The AREA record indicates the beginning of data for a particular area, subarea, or group. The AREA record is followed by a data record which contains the name of the area or group (for example, URBAN, RURAL, BLACK, or NATIVE BORN).

```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
AREA
areanm
*-----------------------------------------------------------------------------
```

Record   Columns   Field   Definition
----
  1   1-4   AREA   Indicates this is an AREA record.

  2   1-80   *areanm*   Name of the area or group being projected.

3.2 The TOT Record: Total Country

     The TOT record indicates that the following input refers to the total country (or
other unit). The TOT record consists only of the letters "TOT" in columns 1-3 of the
record. In phase 1 (see order group 3 in table 2, page 34), it can be used to specify
a total country projection which may or may not be followed by an AREA record in phase
2. If the TOT record is in phase 1 or 2, then an AREA record is required for phase 3
to compute the residual population projection. Similarly, a TOT record is needed in
phase 3 to indicate that an aggregation of the data for the AREAs in phases 1 and 2 is
desired.

```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|--------|
TOT
*-----------------------------------------------------------------------------
```

3.3 The CODE Record: Area Reference Number for Intermediate File

     The CODE record specifies the area reference number to help identify the data and
indicates that the projected data should be stored in an intermediate file for later
aggregation.

```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|--------|
CODE          arnum
*-----------------------------------------------------------------------------
```

Record   Columns   Field   Definition
----
  1   1-4   CODE   Indicates this is a CODE record.

           5-14   blank

           15-20   *arnum*   Area reference number. This number must be right-
                                 justified.

Example: Select the area to be projected

```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
...
AREA
URBAN
CODE              1
....
AREA
RURAL
CODE             20
...
TOT
*-----------------------------------------------------------------------------
```
A three-phase projection is desired. The first area, urban, is assigned the arbitrary
number 1 and the second area, rural, is assigned the arbitrary number 20. The results
of each of the first two areas will be stored in intermediate files and summed to
derive the total.

4. Projection Parameters

The parameter records described in this section define the base population, mortality, fertility and international and internal migration data to be used in projecting the urban, rural, and/or total populations.

In general, all of the projection parameter records (and corresponding data records) of a particular type for a particular year must be together. Where applicable, data must be provided for each sex (or both sexes combined). Also, the component data (fertility, mortality, and migration) must be in chronological order within each component. Other than these restrictions, the order of records in this section is flexible. Thus, the user can either put all the data for one component together or alternate the data so the inputs for all components are in chronological order.

4.1 The POP Record: Base Population

The POP record and the population data that follow are used to input the base population data.

```
*----------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
POP sayear        na        p0        tpop
    pop 1     pop 2     pop 3     pop 4     pop 5   etc.
*-------|---------|---------|---------|---------|---------|---------|---------|
```

| Record | Columns | Field | Definition |

| 1 | 1-3 | POP | The characters `POP' to identify population data. |

| | 5 | *s* | The sex of the population data:
 M = Male
 F = Female
 E = Each sex (male then female) |

| | 6 | *a* | Age grouping of the data:
 0 or blank = default age grouping
     1 if N record provided
     5 if N5 record provided
 1 = Single years of age
 4 = Ages 0 (under 1), 1-4, 5-9, etc.
 5 = Ages 0-4, 5-9, etc. (the population age 0 can be entered in columns 21-30 of this record). |

```
--------------------------------------------------------------------------------
Record     Columns     Field     Definition
--------------------------------------------------------------------------------
  1         7-10       year      Year to which the population data refer; in this
                                 case, the base year of the projection.  POP records
                                 after the first can have a blank year field, in which
                                 case the same year is assumed for all POP records.

           11-20       na        Number of age groups for the program to read.  This
                                 number can be greater than the figure specified on
                                 the N5 or N record, in which case the program will
                                 add together the populations in the last age groups
                                 in order to obtain the number of age groups specified
                                 on the N or N5 record.

           21-30       p0        The population age 0 (under 1).  This allows the user
                                 to input the population data in 5-year age groups
                                 (a=5), but still include an estimate for age 0.  The
                                 inclusion of the age 0 population results in a better
                                 splitting of the population into single years of age.

  1        31-40       tpop      Total population for this sex.  This allows the user
                                 to input a total population that is different from
                                 the sum of the population figures by age.  This can
                                 be useful if an independent total was determined
                                 (e.g., by a post-enumeration survey) but you want to
                                 use the same distribution by age.  If you enter a
                                 figure  tpop, the population data by age are
                                 proportionately adjusted to that total.

  2         1-10       pop1      Population data for first age group.

           11-20       pop2      Population data for the second age group.

           ...

           71-80       pop8      Population data for the eighth age group.

  3         1-10       pop9      Population data for the ninth age group.

 ...        ...                  etc.
--------------------------------------------------------------------------------
```

Example 1: Input the population by 5-year age groups
```
*-------------------------------------------------------------------------------
*       10       20       30       40       50       60       70       80
*        |        |        |        |        |        |        |        |
POP M51950              40100
    172500   141200   122000   105400    90100    76500    64600    54100
     44800    36600    29200    22600    16600    11400     7000     3600
      1800
*-------------------------------------------------------------------------------
```
Male population data are entered for 17 5-year age groups (0-4 through 80+). The
population under age 1 (40,100) is entered on the <u>POP</u> record.

In some cases, you may wish to specify the population by single years of age for
part of the age distribution (e.g., the population ages 0 to 4) while using the BEERS
split[1] population for the remaining ages. This can be accomplished by first including
a <u>POP</u> record with an age code of 5 followed by the population in 5-year age groups,
then coding a second <u>POP</u> record indicating single year data with *na*=5 followed by the
data for ages 0, 1, 2, 3, and 4. This is the only case where *na* can be less than N.

Example 2: Provide supplementary population data by single years
```
*-------------------------------------------------------------------------------
*       10       20       30       40       50       60       70       80
*        |        |        |        |        |        |        |        |
POP M51950              40100
    172500   141200   122000   105400    90100    76500    64600    54100
     44800    36600    29200    22600    16600    11400     7000     3600
      1800
POP M11950        5
     40100    35985    33571    31977    30867
*-------------------------------------------------------------------------------
```
If this method is used to input single-year age data for selected ages, the 5-year
data for all ages must appear first (to allow preliminary splitting), and all the data
for one sex must be together.

Example 3: Adjust the population data to a new total
```
*-------------------------------------------------------------------------------
*       10       20       30       40       50       60       70       80
*        |        |        |        |        |        |        |        |
POP M51950              40100  1200000
    172500   141200   122000   105400    90100    76500    64600    54100
     44800    36600    29200    22600    16600    11400     7000     3600
      1800
*-------------------------------------------------------------------------------
```
The sum of the data by age is only 1,000,000. Each figure will be multiplied by the
ratio 1,200,000/1,000,000 so the initial total male population will be 1,200,000.

----

[1]H. S. Beers. 1945. "Modified-Interpolation Formulas That Minimize Fourth
Differences," <u>Record of the American Institute of Actuaries</u>, Vol. 34, June,
pp. 14-61.

4.2 Mortality Parameter Records

The RUP program allows the mortality of the population to be described in different ways, depending on the quality of the base mortality data and the types of assumptions about changes in mortality that you wish to make.

The methods used for estimating the separation factor are summarized in table 3. All of the mortality input types (except MLT) allow you to input the separation factor for infant deaths. If no separation factors are provided as input, then the Coale-Demeny formula relating the separation factor to the infant mortality rate will be used (see part G, section 6, p. 84).

If at least one separation factor is provided as input, the method mhay vary. For any mortality input where the separation factor is specified, it will be used. For any other input without separation factors, the method depends on the type of input. For MX, QX, DTH, and MXM (extrapolation) input, the Coale-Demeny formula will be used. For MXM interpolation input, the separation factor will be linearly interpolated using the same interpolation factors as for the $_nm_x$ values. For years between mortality inputs, the separation factors will be linearly interpolated.

Table 3. Methods for Estimating the Separation Factor for Infant Deaths

Mortality estimate type	No sep0's entered	At least one *sep0* entered	
		sep0 on this parameter record	*sep0* not on this parameter record
MLT	CD	(X)	CD
MX or QX	CD	*sep0*	CD
DTH	CD	*sep0*	CD
MXM (interp.)	CD	*sep0*	interpolate using mx factors
MXM (extrap.)	CD	*sep0*	CD
Intermediate year	CD	(X)	interpolate using year

X   Not applicable.
CD   Uses Coale-Demeny formula.
sep0 Uses the input separation factor (*sep0*) on the parameter record.

4.2.1 The MX Record: Age-Sex-Specific Central Death Rates

The MX record initiates the input of age-sex-specific central death rates, $_nm_x$. The MX record is preferable to the QX record (see below) because it allows you to specify the level of mortality in the open-ended age group.

```
*------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
MX  sayear      sep0      sep1      na        adj
      mx1       mx2       mx3       mx4       mx5   etc.
*------------------------------------------------------------------------
```

| Record | Columns | Field | Definition |

Record	Columns	Field	Definition
1	1-2	MX	The characters `MX' in columns 1-4 indicate that this is an MX record.
	5	*s*	The sex of the population data: M = Male F = Female E = Each sex (male then female)
	6	*a*	Age grouping of the data: 0 or blank = default age grouping: 1 if N record provided 4 if N5 record provided 1 = single years of age 4 or 5 = ages 0 (under 1), 1-4, 5-9, etc.
	7-10	*year*	Year to which the data refer.
	11-20	*sep0*	Separation factor for infant deaths. Include the decimal point in the value. If this value is blank or 0, the Coale-Demeny equations will be used to estimate an appropriate value based on the region code entered on the REG record.
	21-30	*sep1*	Separation factor for deaths, ages 1 to 4 years. Include the decimal point in the value. If this value is blank or 0, the Coale-Demeny equations will be used to estimate an appropriate value based on the region code entered on the REG record.

```
--------------------------------------------------------------------------------
Record    Columns    Field    Definition
--------------------------------------------------------------------------------
          31-40      na       Number of age groups of data to be read.  If you want
                              to use the default values, enter blank or 0 in this
                              field.  The default values are:
                                nage1     if a = 1
                                nage5 + 1 if a = 4 or 5
                              This value can be less than these default values only
                              when supplementary rates by single years of age are
                              being entered.  It can never be greater than the
                              default value.

          41-50      adj      Adjustment flag.  A non-zero value indicates that the
                              single-year death rates for ages 1, 2, 3, and 4 years
                              (created in the program based on the death rate for
                              ages 1-4 and the separation factor for ages 1-4)
                              should be adjusted in order to reproduce the input
                              death rate for ages 1 to 4.  This provision applies
                              only to the rates for the base year of the
                              projection, and it is available to insure
                              correspondence between the number of deaths based on
                              single years of age and those based on ages 0, 1 to 4
                              years, and 5-year age groups beginning with 5 to 9
                              years. If you select the adj option, the separation
                              factor, sep1, may not be preserved.

   2      1-10       mx1      Age-specific central death rate for the first age
                              group, $_1m_0$.

          11-20      mx2      Age-specific central death rate, second age group:
                                $_1m_1$ if a = 1
                                $_4m_1$ if a = 4 or 5

          21-30      mx3      Age-specific central death rate, third age group:
                                $_1m_2$ if a = 1
                                $_5m_5$ if a = 4 or 5

          ...        ...      ...

          71-80      mx8      Age-specific central death rate, eighth age group:
                                $_1m_7$  if a = 1
                                $_5m_{30}$ if a = 4 or 5

...       ...        ...      etc.
--------------------------------------------------------------------------------
```
Note: The decimal point must be included in all rates. Rates are expressed as annual
deaths per person-year lived.

Example 1: Provide age-specific central death rate ($_nm_x$) input for an abridged life
table.
```
*-----------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
N5                 17
...
MX  F41950
   0.16145   0.02496   0.00551   0.00429   0.00576   0.00732   0.00827   0.00939
   0.01047   0.01157   0.01313   0.01748   0.02318   0.03468   0.04952   0.07575
   0.11440   0.22752
*-----------------------------------------------------------------------------
```
Central death rates for females for the year 1950 have been entered for the age groups
0, 1-4, 5-9, etc. The last value shown (0.22752) is the central death rate for women
80 years and older in 1950.

Example 2: Provide supplementary single-year central death rate ($_1m_x$) input
```
*-----------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
N5                 17
...
MX  F41950
   0.16145   0.02496   0.00551   0.00429   0.00576   0.00732   0.00827   0.00939
   0.01047   0.01157   0.01313   0.01748   0.02318   0.03468   0.04952   0.07575
   0.11440   0.22752
MX  F11950                                5
   0.16145   0.04000   0.03000   0.02000   0.01000
*-----------------------------------------------------------------------------
```
Supplementary data for single years of age up to a certain age can be read in after
the 5-year data in a similar manner to that described in Section 4.1 for population
data (see example 2, page 48). The single-year $_1m_x$ values for ages 0, 1, 2 , 3, and 4
have been entered after the $_1m_0$, $_4m_1$, and $_5m_x$ values for 5-year age groups, beginning
with ages 5-9 years.

4.2.2 The QX Record: Age-Sex-Specific Probabilities of Dying

    The QX record is similar to the MX record and indicates that the mortality data
are in the form of age-specific probabilities of dying rather than age-specific
central death rates. The *adj* option is not relevant when the input data are $_nq_x$
values. If the mortality information is specified as age-specific mortality rates ($_nq_x$
values following a QX record), then the program will convert these to age-specific
central death rates ($_nm_x$) for the projection.

```
*-----------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
QX  sayear      sep0      sep1      na
      qx1       qx2       qx3       qx4       qx5  etc.
*-----------------------------------------------------------------------------
```

    The data record format is the same as that indicated in the MX record description
(see pages 50-52).

4.2.3 The MLT Record: Coale-Demeny Model Life Tables

　　The <u>MLT</u> record indicates that the mortality data should be generated based on a Coale-Demeny regional model life tables.

```
*------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|--------|
MLT sayear      e0
*------------------------------------------------------------------------
```

| Record | Columns | Field | Definition |

1	1-3	MLT	Indicates an <u>MLT</u> record.
	5	*s*	The sex of the population data: 　　M = Male 　　F = Female
	6	*a*	Age grouping of the data. Although no data records follow this record, the age code indicates how the life table should be constructed. 　　0 or blank = default age grouping: 　　　　1 if <u>N</u> record provided 　　　　5 if <u>N5</u> record provided 　　1 = Single years of age 　　5 = 5-year age groups If *a* = 1, age-specific central death rates will be obtained so that the complete life table will reproduce the specified *e0* value. This procedure assumes, for ages 5 years and over, that each single-year central death rate in a given 5-year age group equals the 5-year age group central death rate.
	7-10	*year*	Year to which the data refer.
	11-20	*e0*	Life expectancy at birth. The decimal point must be included in the *e0* value. If an <u>MLT</u> record for one sex is followed by an <u>MLT</u> record for the opposite sex for the same year, the corresponding Coale-Demeny expectation of life at birth for the second sex can be obtained by coding 99.0 as the *e0* value.

<u>4.2.4 The MXM Record: Modification of Age-Sex-Specific Death Rates</u>

The <u>MXM</u> record indicates that age-specific central death rates ($_nm_x$) are to be estimated in order to obtain the expectation of life at birth (*e0*) value specified in columns 11 to 20.

```
*-------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
MXM s year        e0        sep0
*-------------------------------------------------------------------------------
```

Record	Columns	Field	Definition
1	1-3	MXM	Indicates an <u>MXM</u> record.
	5	*s*	The sex of the population data: M = Male F = Female
	7-10	*year*	Year to which the data refer.
	11-20	*e0*	Expectation of life at birth desired for this year.
	21-30	*sep0*	Separation factor for infant deaths. If the separation factor is entered, it is used in the life table. If the *sep0* field is blank or 0, refer to table 3, page 49, for the method used to estimate the value.

The <u>MXM</u> record operates in tandem with the other mortality information provided as input. If a life table is defined for an earlier year (<u>MX</u>, <u>QX</u>, <u>MLT</u>, or <u>DTH</u> record) and a later year (<u>MX</u>, <u>QX</u>, or <u>MLT</u>), then the program will linearly interpolate the logarithms of the $_nm_x$ values in order to obtain the specified life expectancy at birth (*e0* in columns 11-20). This is the preferred method because the surrounding life tables place limits on the possible values of the interpolated rates. In general, each projection will begin with an estimated life table based on available data. You can project future levels of life expectancy by fitting a function to the available data or by other analysis. For the last year of the projection, you can select or construct a life table or specify an "ultimate" life table for a year beyond the projection period with a life expectancy exceeding the one projected for the last year of the projection. Finally, you can use the <u>MXM</u> records to plot the course of life expectancy between the base and final life tables.

In order for this interpolation procedure to work properly, the life expectancies specified on the <u>MXM</u> records must be within the range of those implied by the surrounding life tables that will be used for the interpolation. If they are outside that range, the program will extrapolate instead of interpolate and will display a warning message because the resulting $_nm_x$ values may be unrealistic. The extrapolated values could even be negative or greater than 1, in which case the program would stop.

An alternate procedure is used if two surrounding life tables are not available. In this case, the program extrapolates the age-specific central death rates using the age pattern of mortality in the nearest input empirical life table and the age-specific pattern of changes in mortality implied by the Coale-Demeny model life tables. The <u>MXM</u> record can be used to produce life tables for years prior to or following those years for which empirical life tables are available. This alternate procedure can also produce unrealistic results, depending on how close the empirical life table pattern is to the selected Coale-Demeny model.

Example 1: Interpolate to estimate age-specific central death rates.
```
*-------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
PROJ  2050
...
```

```
* BASE EMPIRICAL LIFE TABLE
MX   M41980
...
MX   F41980
...
MXM M 1990      60.00
MXM F 1990      65.00
...
* ULTIMATE LIFE TABLE
MX   M42100
...
MX   F42100
...
*-------------------------------------------------------------------------------
```
The life tables for 1990 will be computed by interpolating between the 1980 life
tables and the 2100 "ultimate" life tables to obtain life expectancies at birth of
60.00 and 65.00 for males and females, respectively.

Example 2: Extrapolate to estimate age-specific central death rates.
```
*-------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
PROJ  2050
REG               1
...
MXM M 1980      55.00
MXM F 1980      60.00
...
MX   M41985
...
MX   F41985
...
MXM M 2050      80.00
MXM F 2050      85.00
*-------------------------------------------------------------------------------
```
These MXM records will produce life tables for 1980 and 2050 by the extrapolation
method using the 1985 life tables and the patterns of change from the Coale-Demeny
west region.

<u>4.2.5 The DTH Record: Deaths by Age and Sex</u>

The <u>DTH</u> record describes the data on deaths that follow. This record instructs the program to project the population using mortality data consistent with the input data on deaths. The program projects the population using the age-specific central death rates ($_nm_x$) for the prior year and from the following life table (as defined by a <u>MX</u>, <u>QX</u>, or <u>MLT</u> record). For each age and sex group of input deaths, the surrounding $_nm_x$ values are interpolated to obtain the number of deaths specified in the input.

```
*---------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
DTH s year        na    bsdth    mdth     fdth
SEP0          sep0m    sep0f
  age  wid    maled    femd
       or
  age  wid    bsexd
*---------------------------------------------------------------------------
```

Record   Columns   Field   Definition

Record	Columns	Field	Definition
1	1-3	DTH	Indicates a <u>DTH</u> record.

	5	*s*	The sex of the death data by age:
			    E or blank = each sex (male then female)
			    B = both sexes

	7-10	*year*	Year to which the data refer.
	18-20	*na*	Number of age groups of death data (number of data records). This number can vary from 0 (totals only) to the number of single years of age (up to 101). If *na* is 0, no data records follow this <u>DTH</u> record.
	21-30	*bsdth*	Total deaths for both sexes. If this record is entered, it takes precedence over the *mdth* and *fdth* data, as well as the data on deaths by age. In this case, the other death data will be proportionally adjusted to obtain this specified total.

56

```
--------------------------------------------------------------------------------
Record    Columns    Field    Definition
--------------------------------------------------------------------------------
          31-40      mdth     Total male deaths.  If this is entered, it takes
                              precedence over the data on deaths by age.  If mdth +
                              fdth is not equal to bsdth, then the bsdth total will
                              be split by sex based on the ratio of mdth to fdth.
                              The data by age for males will be proportionally
                              adjusted to obtain the total male deaths (either mdth
                              or (bsdth)x(mdth)/(mdth+fdth)).

          41-50      fdth     Total female deaths.  See notes for mdth.

  2       1-4        SEP0     Indicates this is a SEP0 record.  This record is
                              optional, and should be included only if the user
                              needs to enter the separation factor of infant
                              deaths.  This record, if present, must immediately
                              follow the DTH record.  If this record is not
                              present, the separation factors will be estimated
                              using the Coale and Demeny equations.

          11-20      sep0m    Separation factor of male infant deaths.  The decimal
                              point must be included.

          21-30      sep0f    Separation factor of female infant deaths.  The
                              decimal point must be included.

 2 or 3   1-5        age      Lower limit of the age group.

          6-10       wid      Width of the age interval. Open-ended age groups
                              should be coded with a width of 999.

If s = blank or E on the DTH record:

          11-20      maled    Male deaths for this age group.

          21-30      femd     Female deaths for this age group.

If s = B on the DTH record:

          11-20      bsexd    Both sexes deaths for this age group.

There should be a total of na records with death data by age.
--------------------------------------------------------------------------------
```

When any adjustment is made to the input deaths based on the comparison of bsdth,
mdth, fdth, and the data by age, a warning message is written to the input list file.
The entry of different totals allows the user to enter reported deaths by age and sex,
and adjusted total deaths (optionally by sex) based on analysis of the mortality data.

   The age groups can be any width, and they do not need to be equal: some can be
single years, some 5-year and/or 10 year groups. In addition, the open-ended age
group can start at any age less than or equal to the open-ended age group used in the
projection.

Example 1: Enter the number of infant and non-infant deaths
```
*-----------------------------------------------------------------------
*       10       20       30       40       50       60       70       80
*        |        |        |        |        |        |        |        |
DTH B 1983        2     6000     3000     3000
    0    1     2000
    1  999     4000
*-----------------------------------------------------------------------
```
The infant deaths are available only for both sexes combined.

Example 2: Enter only the total number of deaths

```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
DTH E 1984          0      6100      3050      3050
*------------------------------------------------------------------------------
```
The number of ages is entered as 0, and no death data records are entered.

Example 3: Enter data for mixed age groups
```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
DTH E 1980         13
SEP0                .25       .26
     0    1       1000       900
     1    1        100        90
     2    1         50        45
     3    1         25        22
     4    1         10         9
     5    5         40        36
    10    5         35        32
    15    5         40        36
    20   10         90        81
    30   10        200       180
    40   10        300       270
    50   10        400       360
    60  999       2000      1800
*------------------------------------------------------------------------------
```
Data for available age groups are entered without alteration. Since no totals are entered on the DTH record, the sum of the deaths by age will be used.

    The number of deaths in the projection can be printed by including an ODTH record in the input file (see page 75).

4.3 Fertility Parameter Records

The ASFR, TFR, and BTH records are used to describe changes in fertility during the projection period.

4.3.1 The ASFR Record: Age-Specific Fertility Rates

The ASFR record and data records that follow specify age-specific fertility rates for a given year.

```
*-----------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
ASFR ayear       ia
    asfr1    asfr2    asfr3    asfr4    asfr5  etc.
*-----------------------------------------------------------------------------
```

Record   Columns   Field   Definition
----
  1   1-4   ASFR   Indicates that this is an ASFR record.

          6   *a*   Age grouping of the data:
                                  0 or blank = default age grouping:
                                      1 if N record provided
                                      5 if N5 record provided
                                  1 = single years of age
                                  5 = 5-year age groups

          7-10   *year*   Year to which the data refer.

          11-21   *ia*   Initial age of the fertility rates. If the *ia* field
                              is 0 or blank, the default value of 15 will be used.
                              Only values of 10 or 15 are acceptable if 5-year age
                              groups are specified (*a*=5), and the value of *ia* can
                              take on any value from 10 to 19 if single-year
                              ASFR's are specified (*a*=1).

```
--------------------------------------------------------------------------------
Record    Columns    Field    Definition
--------------------------------------------------------------------------------
The age-specific fertility rates are coded in successive 10-column fields on records
following the ASFR record.  These rates should be expressed as births per woman in
each age group, and the decimal point must be coded.

   2        1-10      asfr1    ASFR for first age group:
                                    15-19 if a=5 and ia=0, blank, or 15
                                    10-14 if a=5 and ia=10
                                    15    if a=1 and ia=0, blank or 15
                                    ia    if a=1 and ia=10, 11, 12,.., or 19

           11-20      asfr2    ASFR for second age group:
                                    20-24 if a=5 and ia=0, blank, or 15
                                    15-19 if a=5 and ia=10
                                    16    if a=1 and ia=0, blank or 15
                                    ia+1  if a=1 and ia=10, 11, 12, .., or 19

           ...        ...      ...

           61-70      asfr7    ASFR for seventh age group:
                                    45-49 if a=5 and ia=0, blank, or 15
                                    40-44 if a=5 and ia=10
                                    21    if a=1 and ia=0, blank or 15
                                    ia+6  if a=1 and ia=10, 11, 12, .., or 19

           71-80      asfr8    ASFR for eighth age group:
                                    blank if a=5 and ia=0, blank, or 15
                                    45-49 if a=5 and ia=10
                                    22    if a=1 and ia=0, blank or 15
                                    ia+7  if a=1 and ia=10, 11, 12, .., or 19

If a=1 (single years of age), additional records must be included to enter the ASFR's
up to and including age 49.
--------------------------------------------------------------------------------

Example 1:   Enter ASFR's for the default 5-year age groups
*------------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
ASFR 51950
     0.1107    0.2583    0.3440    0.2706    0.1722    0.0615    0.0123
*------------------------------------------------------------------------------
```

```
Example 2:  Enter ASFR's for single years of age
*------------------------------------------------------------------------
*      10       20       30       40       50       60       70       80
*       |        |        |        |        |        |        |        |
ASFR 11989       14
     0.0001   0.0005   0.0023   0.0086   0.0249   0.0522   0.1137   0.1687
     0.2205   0.2753   0.2945   0.2947   0.2624   0.2113   0.1675   0.1298
     0.1011   0.0796   0.0630   0.0537   0.0429   0.0335   0.0331   0.0250
     0.0222   0.0231   0.0155   0.0105   0.0107   0.0071   0.0068   0.0036
     0.0012   0.0010   0.0006   0.0003
*------------------------------------------------------------------------
```
ASFR's are entered by single years of age. Since *ia*=14, the first ASFR is for age 14.
The last ASFR (0.0003) is for women aged 49.

4.3.2 The TFR Record: Total Fertility Rates

     The TFR record is used to specify the desired total fertility rate for the year
coded in columns 7 to 10. The TFR record tells the program to either:

(1)   Interpolate between surrounding ASFR's to obtain a set of ASFR's that
        corresponds to a TFR=tfr, or

(2)   Proportionally adjust the nearest set of ASFR's to obtain a TFR=tfr.

```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|--------|
TFR   year      tfr
*------------------------------------------------------------------------------
```

Record   Columns   Field   Definition
----
  1   1-4   TFR   Indicates this is a TFR record.

          7-10   year   Year to which the data refer.

          11-20   tfr   The desired total fertility rate for this year. The
                              decimal point must be included.

     When using the TFR record to interpolate between sets of ASFR's, exercise caution
if the ASFR for any age is changing in the opposite direction from the TFR (e.g., the
TFR is decreasing, but the ASFR for ages 25-29 is increasing) and/or the difference
between TFR values for the surrounding ASFR's is very small. In either of these
situations, the program will display a warning message. If the specified TFR value is
outside the range of TFR values for the surrounding sets of ASFR's, individual
interpolated ASFR values can take on unlikely values. If this occurs, you should
estimate a set of ASFR's for the intermediate year (perhaps by taking an average of
the surrounding ASFR's and adjusting to the desired TFR).

     In contrast to other projection parameter records, a TFR record for the same year
can follow an ASFR record and ASFR data. In this case, the ASFR data are
proportionally adjusted to the value tfr as specified on the TFR record.

Example 1: Use the same ASFR pattern
```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
TFR   1975      6.50
ASFR 51980
     0.1107    0.2583    0.3440    0.2706    0.1722    0.0615    0.0123
TFR   1985      5.50
*------------------------------------------------------------------------------
```
If these are the only fertility inputs, the program will proportionally adjust the
input ASFR's for 1980 to a TFR of 6.5 for 1975 and 5.5 for 1985.

```
Example 2:  Interpolate between sets of ASFR's
*-----------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
ASFR 51950
     0.1107    0.2583    0.3440    0.2706    0.1722    0.0615    0.0123
TFR  1980     4.00
ASFR 52000
     0.02      0.08      0.10      0.10      0.07      0.02      0.01
*-----------------------------------------------------------------------------
```
The ASFR's for 1980 will be determined by interpolating between the ASFR's for 1950
and 2000, using the TFR values to compute the interpolation coefficients (see part G,
section 2, p. 82).

```
Example 3:   Adjust ASFR's for a single year
*-----------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*        |         |         |         |         |         |         |         |
ASFR 51980
     0.1107    0.2583    0.3440    0.2706    0.1722    0.0615    0.0123
TFR  1980     5.50
*-----------------------------------------------------------------------------
```
The program will proportionally adjust the input ASFR's for 1980 to a TFR of 5.50.

4.3.3 The BTH Record: Births by Age of Mother

The BTH record is used to input data on births. The birth data can include totals by sex, and births by age.

```
*-----------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
BTH   year        na      bsbth     mbth      fbth
  age   wid     bsexb
*-----------------------------------------------------------------------
```

Record	Columns	Field	Definition
1	1-4	BTH	Indicates the BTH record.
	7-10	*year*	Year to which the data refer.
	11-20	*na*	Number of age groups, which is the number of data records that follow. This can range from 0 (totals only) to the number of single years of age (40, ages 10 to 49). If *na*=0, then no data records are expected.
	21-30	*bsbth*	Total births for both sexes. If this item is entered, it takes precedence over the *mbth* and *fbth* data and the data on births by age. The other birth data will be proportionally adjusted to obtain this total.
	31-40	*mbth*	Total male births.
	41-50	*fbth*	Total female births.
2	1-5	*age*	Lower limit of the age group. This can vary from 10 to 49.
	6-10	*wid*	Width of the interval. This can vary from 1 to 40.
	11-20	*bsexb*	Births for both sexes for this age group.

The total births by sex on the BTH record can be used to make adjustments to the data. The program will compare the total births for both sexes (*bsbth*) to the sum of the male and female births (*mbth* + *fbth*). If they are not the same, the male and female births will be proportionally adjusted. Similarly, the total births on the BTH record will be compared to the sum of the age data given, and the data by age will be proportionally adjusted if the sum differs from the desired total. When any adjustment is made to the input births, a warning message is written to the input list file. This feature allows you to enter reported births by age and adjusted total births based on analysis of the fertility data.

```
Example 1:  Enter births for 5-year age groups of women
*-----------------------------------------------------------------------
*         10        20        30        40        50        60        70        80
*          |         |         |         |         |         |         |         |
BTH                  7     20500     10500     10000
   15    5      2000
   20    5      5000
   25    5      6000
   30    5      4000
   35    5      2000
   40    5      1000
   45    5       500
*-----------------------------------------------------------------------
The totals all agree, so there would be no adjustment of the data.

Example 2:  Enter births for selected single years of age
*-----------------------------------------------------------------------
*         10        20        30        40        50        60        70        80
*          |         |         |         |         |         |         |         |
BTH                 11     30000       105       100
   15    1         0
   16    1       100
   17    1       400
   18    1       600
   19    1       900
   20    5      5000
   25    5      6000
   30    5      4000
   35    5      2000
   40    5      1000
   45    5       500
*-----------------------------------------------------------------------
```
The births for ages 15 to 19 are given by single years. In addition, the total for
both sexes is different from the sum of the male and female totals, so the male and
female totals will be proportionally adjusted to sum to 30,000. Similarly, since the
sum of the births by age differs from the total for both sexes, the births by age will
be proportionally adjusted to the total of 30,000 for both sexes.

4.4 International Migration Parameter Records

     The MIGN and MIGR records are used to define the nature of international
migration during the projection period. Currently all international migration inputs
for a particular area must be either rates (MIGR) or numbers (MIGN).

4.4.1 The MIGN Record: Net Number of International Migrants

     The MIGN record initiates the input of net numbers of international migrants for
the specified sex, age grouping, and year.

```
*----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
MIGNsayear        na
   migs1    migs2    migs3    migs4    migs5  etc.
*----------------------------------------------------------------------------
```

Record	Columns	Field	Definition
1	1-4	MIGN	Indicates this is a MIGN record.
	5	*s*	The sex of the population data: M = Male F = Female E or blank = Each sex (male then female)
	6	*a*	Age grouping of the data: 0 or blank = default age grouping: 1 if N record provided 5 if N5 record provided 1 = Single years of age 5 = Ages 0-4, 5-9, etc. 9 = All ages. If this code is selected, then there must be at least one other MIGN record followed by migration data by age and sex.
	7-10	*year*	Year to which the data refer.
	11-20	*na*	Number of age groups of input. If this is blank or 0, the number of ages will default to the number of single years of age (if *a*=1) or the number of 5-year age groups (if *a*=5). Enter a value here only if you are entering supplementary single year data (single year data for the youngest ages) or if the data contain more age groups than the number specified on the N5 or N record. If more age groups are specified, the data for the older ages will be aggregated to the open-ended age group to be used in the projection.

66

```
-------------------------------------------------------------------------------
Record     Columns     Field     Definition
-------------------------------------------------------------------------------
```

The net numbers of migrants are coded in successive 10-column fields on data records
following the MIGN record. The numbers should be right-justified or include the
decimal point. Positive values indicate net international migration into the
particular area (i.e., total country, urban, or rural) while negative values indicate
movement from the area or out of the country.

```
   2        1-10        migs1     Net number of migrants for the first age group.

            11-20       migs2     Net number of migrants for the second age group.

            21-30       migs3     Net number of migrants for the third age group.

            ...         ...       ...

            71-80       migs8     Net number of migrants for the eighth age group.
-------------------------------------------------------------------------------
```

When migrant totals are given (*a*=9), the program will interpolate the age pattern
of migrants (the percent distribution for each sex) for the nearest prior and
following years (if available) based on the years, then redistribute using the total
migrants for the sex indicated. If the totals by sex precede the first age/sex data
(or follow the last age/sex data), then the program will use the same pattern as for
the nearest age/sex distribution. Since the percent distribution by age is used, the
interpretation of the results is questionable if the age/sex data on migrants contain
both positive and negative figures, and especially when the sign of the given total is
the opposite of the total(s) for the age distribution(s) used to distribute the given
total.

If the total net number of migrants is zero for an age distribution of migrants
needed for interpolation for a year where totals by sex are provided, then the program
will print out an error message and stop since it cannot create a percent distribution
if the total is zero. Zero totals can be specified for either or both sexes, which
will result in zero migrants at all ages.

```
Example 1:  Enter data for net in and out migration
*-----------------------------------------------------------------------------
*       10         20         30         40         50         60         70         80
*        |          |          |          |          |          |          |          |
MIGNM51950
        349        456        798       2256       3521       2392       1563        953
        622        253        103        -20        -32        -41        -21         -5
         -2
*-----------------------------------------------------------------------------
Net immigration is entered for ages under 55, and net emigration for ages 55 and over.

Example 2:  Enter a fixed pattern of migrants, with changing levels
*-----------------------------------------------------------------------------
*       10         20         30         40         50         60         70         80
*        |          |          |          |          |          |          |          |
MIGNM51980
        900        900        900       2000       3000       3000       2000       1000
          0          0          0          0          0          0          0          0
          0
...
MIGNM91985
      10000
...
MIGNM92000
          0
*-----------------------------------------------------------------------------
```
There is a net in-migration of 13,700 males into the area in 1980. This drops to
10,000 in 1985 and to 0 by the year 2000. All of the migrants are under the age of
40.

4.4.2 The MIGR Record: Age-Sex-Specific International Net Migration
               Rates

        The MIGR record specifies the input of age-sex-specific net international
migration rates.

```
*------------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
MIGRsayear        na
    migr1     migr2     migr3     migr4     migr5   etc.
*------------------------------------------------------------------------------
```

Record   Columns   Field   Definition
----
  1   1-4   MIGR   Indicates this is a MIGR record.

           5   *s*   The sex of the population data:
                                     M = Male
                                     F = Female
                                     E or blank = Each sex (male then female)

           6   *a*   Age grouping of the data:
                                     0 or blank = default age grouping:
                                         1 if N record present
                                         5 if N5 record present
                                     1 = Single years of age
                                     5 = Ages 0-4, 5-9, etc.

           7-10   *year*   Year to which the data refer.

           11-20   *na*   Number of ages of input. If this is blank or 0, the
                                 number of ages will default to the number of single
                                 years of age (if *a*=1) or the number of 5-year age
                                 groups (if *a*=5). Enter a value here only if you are
                                 entering supplementary single year data (single year
                                 data for the youngest ages).

69

```
--------------------------------------------------------------------------------
Record    Columns    Field    Definition
--------------------------------------------------------------------------------
The rates are specified in successive 10-column fields on records following the MIGR
record.  They are expressed as the net number of migrants per person, and the decimal
point must be coded.

  2         1-10      migr1    Migration rate for first age group:
                                   0 (under 1) if a=1
                                   0-4         if a=5


           11-20      migr2    Migration rate for second age group:
                                   1    if a=1
                                   5-9  if a=5


           21-30      migr3    Migration rate for third age group:
                                   2     if a=1
                                   10-14 if a=5


           ...        ...      ...


           71-80      migr8    Migration rate for eighth age group:
                                   7     if a=1
                                   35-39 if a=5


           ...        ...      ...

--------------------------------------------------------------------------------

Example:  Enter data for net in and out migration
*------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
MIGNM51950       17
    -0.001    -0.002    -0.003    -0.004    -0.005    -0.005    -0.005    -0.004
    -0.003    -0.002    -0.001     0.000     0.001     0.002     0.003     0.002
     0.001
*------------------------------------------------------------------------
Men under age 55 are leaving the area, but men ages 60 and over are entering the area.
```

     The RUMN and RUMR records indicate the input of net internal (usually rural-to-
urban or urban-to-rural) migrant numbers and migration rates, respectively. These
records are valid inputs only for the first phase defined by an AREA record in the
projection (usually the rural population projection in phase 1). If phase 1 is the
total country projection (contains a TOT record), then the RUMN or RUMR records must
be in phase 2. If rates are used, be sure that the base of the rates is the same as
the area of the projection and that the sign is correct (if the migrants are leaving
the area, the values should be negative). The program will print a warning message in
the listing log if an AREA record is present but no internal migration data (RUMN or
RUMR records) are found.

     The RUMN and RUMR records are coded the same as the MIGN and MIGR records,
respectively.

```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*-------|---------|---------|---------|---------|---------|---------|---------|
RUMNsayear          na
    migs1     migs2     migs3     migs4     migs5   etc.
*
RUMRsayear          na
    migr1     migr2     migr3     migr4     migr5   etc.
*-----------------------------------------------------------------------------
```

Example 1: Enter internal migration rates
```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
...
AREA
RURAL
...
RUMRM51950
       0.0    -0.001    -0.002    -0.003    -0.004    -0.005    -0.004    -0.003
     -0.002    -0.001       0.0     0.001     0.002     0.003     0.002     0.001
       0.0
RUMRF51950
       0.0    -0.001    -0.002     0.001     0.001       0.0       0.0
       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
       0.0
*-----------------------------------------------------------------------------
```
Children 5-9 and 10-14 and men 15 to 49 are leaving the rural area, while women 15 to
24 and men 55 to 79 are moving into the rural area.

5. Output Specifications

     The following records are used to specify the desired output. If no output
records are specified, the full-page output is produced for every year of the
projection. The specified outputs are sent to disk files which can be selectively
printed using the RUPMENU program.

     The output specification records are cumulative: those specified during phase 2
(usually the urban phase) are added to those previously specified in the first phase.
However, the specifications for a particular *type*/*s*/*a*/*dsrn* combination must be entered
in chronological order.

```
*------------------------------------------------------------------------
*       10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
OUTPsayear      frq       yfr       dsrn
OPOPsayear      frq       yfr       dsrn
OMX sayear      frq       yfr       dsrn
ODTHsayear      frq       yfr       dsrn
OBTHsayear      frq       yfr       dsrn
*------------------------------------------------------------------------
```

Record   Columns   Field   Definition
----

  1   1-4   type   OUTP = detailed output
                                  OPOP = population output
                                  OMX = $_nm_x$ or life table output
                                  ODTH = output of deaths by age and sex
                                  OBTH = output of births by age of mother

        5   *s*   The sex of the population data:
                                  M   = Male
                                  F   = Female
                                  E or blank = Each sex (male then female)

        6   *a*   Age grouping of the data:
                                  0 or blank = default age grouping:
                                    1 if N record present
                                    5 if N5 record present
                                  1 = Single years of age
                                  4 = Ages 0 (under 1), 1-4, 5-9, etc.
                                  5 = Ages 0-4, 5-9, etc.

        7-10   *year*   Initial year of desired output. This year does not
                                  have to be within the projection period. A blank
                                  year specifies the base year of the projection.

```
--------------------------------------------------------------------------------
Record    Columns    Field     Definition
--------------------------------------------------------------------------------
          11-20       frq      Frequency with which the particular data are to be
                               written out.  For example, enter code 5 if you want
                               the data written out every 5 years, starting with the
                               year specified in the year field.  Blank, 0, or code
                               1 specify output for every year.

          21-30       yrf      Final year that this output operation is to be
                               performed.  Specify the same year in the yrf and year
                               fields to indicate that this output is desired for
                               only that year.  If you enter yrf as blank or equal
                               to 0, the output will be produced until the end of
                               the projection or until another output specification
                               record with the same type/s/a/dsrn combination is
                               encountered.  If you enter another output
                               specification record with the same type/s/a/dsrn
                               combination, the earlier specification will remain in
                               effect only until the year specified on the second
                               record is reached.

          31-40       dsrn     Data set reference number for an alternate file for
                               the particular output.  Data set reference numbers
                               are arbitrary symbols used in the program to refer to
                               a particular input or output device (e.g., keyboard,
                               printer, disk file). In this case the value of dsrn
                               will be associated with a particular disk file.
                               -Usually, you will leave this field blank, and the
                               output will be sent to the default file for later
                               printing.
                               -If you enter a non-zero value for dsrn, the output
                               is generally produced in a format similar to the
                               input to RUP and can in fact be used as input to
                               other RUP runs.  This means that the actual data are
                               preceded by a parameter record which indicates the
                               type of data that follows, including the
                               age-grouping, sex, and year.
                               -The program will check to be sure that the  value
                               specified for dsrn is not the same as any of the
                               pre-assigned values used by the program (see table 4,
                               page 74).
                               -If you give a non-zero value for dsrn, the program
                               will generate a filename for the file created (see
                               table 5, page 74).
--------------------------------------------------------------------------------
```

```
Table 4.  Data Set Reference Numbers (DSRN's) Used by RUP
-------------------------------------
DSRN  File associated with that DSRN
-------------------------------------
1     Input file
2     Intermediate file, phase 1
3     Intermediate file, phase 2
4     Miscellaneous output file
6     Summary table 1
7     Summary table 2
8     Listing file
15    Full-page output
-------------------------------------
```

If you enter a data set reference number (*dsrn*) on an output specification record, the program will ask for a data set name to be associated with that *dsrn* value. If you leave it blank or set it to 0, the output will be added to the end of the full-page output file.

```
Table 5.  Types of Output
-----------------------------------------------------------------------
Table                     |Output record  |Location          |Filename
-----------------------------------------------------------------------
(input file)               not applicable  Input file         input.in
Input listing              always generated Input listing      input.out
Summary table 1            always generated Summary table 1    input1.out
Summary table 2            always generated Summary table 2    input2.out
Population by age and sex  OUTP            Full-page          inputF.out
Vital rates                OUTP            Full-page          inputF.out
Migration data             OUTP            Full-page          inputF.out
Population by single ages  OPOP            Full-page          inputF.out
                           OPOP *          Population         inputP.out
Mx values/life tables      OMX             Full-page          inputF.out
                           OMX *           Mx values          inputM.out
Deaths by age and sex      ODTH            Full-page          inputF.out
                           ODTH *          Deaths             inputD.out
Births by age of mother    OBTH *          Births             inputB.out
-----------------------------------------------------------------------
```
* Output generated when *dsrn* is specified. Output is in RUP input format and cannot be printed by **RUPMENU.**

```
Table         = Type of data or table.
Output record = Output record type needed in input file to get this data.
Location      = Title of output file.
Filename      = Default name of file where output will be stored.
```

5.1 The OUTP Record: Detailed Population, Vital Rates, and Migration Data

The <u>OUTP</u> record indicates the frequency with which the detailed results should be printed. These detailed results usually consist of 3 pages per year (see pages 19-21 for examples): (1) population data by 5-year age groups, (2) vital rates, and (3) migration data by age and sex. The detailed results are the basic components of the full-page output.

Insert an <u>OUTP</u> record with no parameters to reset the program to the default output options to produce detailed output for every year. For example, to change all output options in phase 2 or 3, insert an <u>OUTP</u> record with no parameters followed by the desired output specification records. However, this default output will not be produced if you include any other output specification records. If you want other output specifications in phases 2 or 3, insert the <u>OUTP</u> record with no options first, followed by an <u>OUTP</u> record with the desired options (including at least one value on the record) and then the other output specification records.

5.2 The OPOP Record: Population Data

The output of the population by age and sex is indicated by the <u>OPOP</u> record. If the *dsrn* field is 0 or blank on the <u>OPOP</u> record, there will be no additional output if 5 is coded in the *a* field. This is because the presentation of the population by 5-year age groups is part of the output generated by the <u>OUTP</u> record. However, special tables of population by single years of age will be generated (at the end of the run) if *dsrn* is 0 or blank and *a* = 1. See page 23 for an example of this single-year output.

5.3 The OMX Record: Age-Sex-Specific Central Death Rate or Life Table Data

The <u>OMX</u> record is used to output the age-sex-specific central death rates. Due to possible rounding differences, it is possible to produce this output only for the default age grouping for mortality, which is *a* = 4 unless there is at least one single-year mortality input during the current phase. If *dsrn* is 0 or blank, then the life table for the specified sex, age grouping and year will be printed at the end of the projection. See page 22 for an example of a life table printout.

5.4 The ODTH Record: Deaths by Age and Sex

The <u>ODTH</u> record is used to produce data on deaths by age and sex. These data are useful when data on deaths by age are provided as input on the <u>DTH</u> record. If no *dsrn* is included, the table of deaths by age and sex will be part of the full-page output file.

5.5 The OBTH Record: Births by Age of Mother

The <u>OBTH</u> record is used to obtain output of births by age of mother. This output can be useful for comparing the results of the projection to registration data. Since the births by 5-year age group of mother are produced as part of the detailed output file (determined by the <u>OUTP</u> record), the output will be produced only if the *dsrn* field is non-zero, which will send the output to a separate file.

Example 1: Request population by single years of age
```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
OPOP 11950         5
OPOP 11970        20      2050
OPOP 12025                2025
*-----------------------------------------------------------------------------
```
Population by sex and single years of age will be printed for the years 1950, 1955,
1960, 1965, 1970, 1990, 2010, and 2025.

Example 2: Changing output options
```
*-----------------------------------------------------------------------------
*      10        20        30        40        50        60        70        80
*       |         |         |         |         |         |         |         |
...               |
AREA              |
RURAL             |
...
OUTP  1955        |
OMX   1960         5
END
AREA
URBAN
...
OPOP 11950
TOT
...
OUTP
OUTP  1950         5
OMX   1950        10
ODTH  1980                1990
OPOP 11990         5     2000          9
END
*----------------------------------------------------------------------------
```
Detailed output will be produced for every year starting in 1955 for the rural area,
and life tables will be printed for every fifth year starting in 1960. These items
will also be printed for the urban area with the addition of population by single
years of age starting in 1950.

The OUTP record with no other fields entered erases the previous print specification,
so the output for the total country will consist of:

    (1)   Full-page output for every fifth year starting in 1950
    (2)   Life tables for every tenth year starting in 1960
    (3)   Deaths by age and sex for every year from 1980 to 1990
    (4)   Population by single years of age for 1990, 1995, and 2000 sent to a
           separate file (*dsrn*=9).

6. The END Record: End of Projection Inputs

        The <u>END</u> record signals the end of the current projection.

```
*------------------------------------------------------------------------------
*         10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
END
*------------------------------------------------------------------------------
```

7. The NOTE Record and * (Comment) Records

        The <u>NOTE</u> record informs the program that the *nn* records which follow are to be
printed in the input data log. This allows you to annotate the sources of data or
make comments about the data.

```
*------------------------------------------------------------------------------
*         10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
NOTE              nn
notes ...
*--------|---------|---------|---------|---------|---------|---------|---------|
* comment
*------------------------------------------------------------------------------
```

        Alternatively, you may use the comment line. It is a more convenient method for
annotating the input file because each comment line can be entered directly without
counting the number of lines. Each comment line begins with an asterisk in column 1,
and the comments are contained in columns 2-80. You can place a comment line anywhere
a parameter record is expected.

8. The EDIT Record: Record Scan Without Projection

        The <u>EDIT</u> record can be used to verify that the parameter records for a RUP run
are correct. The <u>EDIT</u> record must be the first record in the run if you select this
feature. The parameter records and data records will be scanned, and any errors
detected will be indicated in the output. This is particularly useful for detecting
input format errors in the second phase of the projection without waiting for the
computer to perform the projection of the first area. The EDIT scan cannot detect
certain errors which may occur during a projection (e.g., dividing by 0).

```
*------------------------------------------------------------------------------
*         10        20        30        40        50        60        70        80
*--------|---------|---------|---------|---------|---------|---------|---------|
EDIT
*------------------------------------------------------------------------------
```

E. Files on the RUP Disk

For the contents of the distribution diskette see:

http://www.census.gov/ipc/www/rup/filelist.txt

F. Program Requirements

   The RUP program requires less than 1MB memory (RAM) and a hard disk drive. The amount of disk space required for the intermediate and output files depends on the length of the projection period: about 7.2KB per year for each intermediate file (if used) and about 14KB per year of the full-page output (including population by age and sex, vital rates, migration data by age, and life tables).

G. Methods Used by the RUP Program

1. Projection Method

    The RUP program projects populations forward one year at a time using calendar-year events. Thus, it uses single year (calendar year) age-specific death rates rather than survival ratios to project a midyear population to the next year. This assumes that the number of deaths from time t to t+1 to the cohort of people aged x at their last birthday at time t (parallelogram A in figure 1) is equal to one-half the sum of the deaths to people aged x at their last birthday during the year centered on t (square B in figure 2) and those to people aged x+1 at their last birthday during the year centered on t+1 (square C in figure 2). If migration is a component in a run of the projection, deaths to the cohort migrants are calculated in a similar manner.
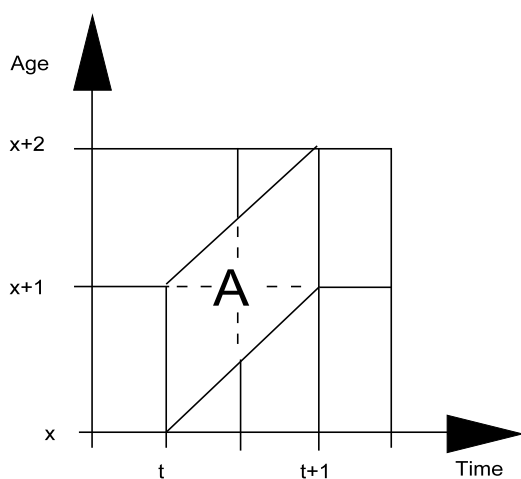
Figure 1. Projected Cohort Events
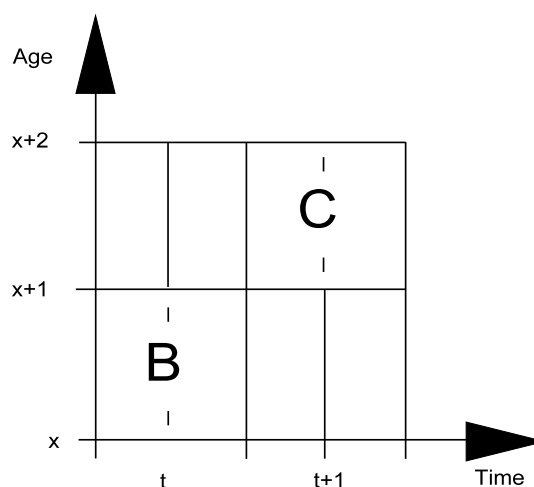
Figure 2. Calendar Year Events

In a projection program, the values of all variables are known for year t, while only the age-sex-specific death rates, age-specific fertility rates, and either the age-sex-specific net migration rates or number of net migrants by age and sex are known for year t+1 (i.e., they are specified as input to the program). In the discussion above, the number of deaths to the population aged x+1 at their last birthday in the year centered on t+1 is unknown (square C in figure 2). Those deaths are equal to the mortality rate for age x+1 (which is known) times the population aged x+1 at time t+1 (which is not known). A similar situation exists with respect to the number of migrants aged x+1 at time t+1, if the input data are in the form of migration rates.

The projection is accomplished through a system of three equations with three unknowns (the population, deaths, and migrants aged x+1 in year t+1).

Definitions:

$P_x(t)$ =   population aged x, last birthday, at time t.

$N_x(t)$ =   net migrants aged x, last birthday, migrating during the year centered on t.

$D_x(t)$ =   deaths aged x, last birthday, dying during the year centered on t.

$n_x(t)$ =   net migration rate for persons aged x, last birthday, during the year centered on t.

$m_x(t)$ =   central death rate for persons aged x, last birthday, during the year centered on t.

Equations:

(1) $P_{x+1}(t+1) = P_x(t) - 0.5D_x(t) + 0.5N_x(t) - 0.5D_{x+1}(t+1) + 0.5N_{x+1}(t+1)$,

(2) $D_{x+1}(t+1) = P_{x+1}(t+1) \, m_{x+1}(t+1)$

(3) $N_{x+1}(t+1) = P_{x+1}(t+1) \, n_{x+1}(t+1)$

Substituting equations (2) and (3) into equation (1) and solving for $P_{x+1}(t+1)$, we get:

$$(4) \quad P_{x+1}(t+1) = \frac{P_x(t) - 0.5D_x(t) + 0.5N_x(t)}{1 + 0.5m_{x+1}(t+1) - 0.5n_{x+1}(t+1)}$$

The number of deaths and migrants in year t+1 can then be computed using equations (2) and (3), after which the population for year t+2 can be determined in a similar manner.

When the migration data are in the form of absolute numbers rather than rates, then equation 3 is unnecessary and the final result is:

$$(5) \quad P_{x+1}(t+1) = \frac{P_x(t) - 0.5D_x(t) + 0.5N_x(t) + 0.5N_{x+1}(t+1)}{1 + 0.5m_{x+1}(t+1)}$$

Since it is assumed that the input migration data are all in the form of age-sex-specific rates or, alternatively, absolute numbers of migrants by age and sex, equations (4) and (5) can be combined by defining a variable, g, which indicates the format of the input migration. Thus, g is set equal to zero when the input migration data are in the form of absolute numbers of migrants, or g is set equal to 1 if the input migration data are in the form of rates:

$$(6) \quad P_{x+1}(t+1) = \frac{P_x(t) - 0.5D_x(t) + 0.5N_x(t) + 0.5N_{x+1}(t+1)(1-g)}{1 + 0.5m_{x+1}(t+1) - 0.5n_{x+1}(t+1)g}$$

When both internal and international migration are used, equation (6) is expanded to include 2 forms of migration (say N and N') with corresponding migration type indicators, g and g'.

As illustrated in figure 3, the same reasoning underlies the projection of the population in the last age group (where age z is the lower limit of the open-ended age group):

$$(7) \quad P_z(t+1) = \frac{P_{z-1}(t) - 0.5D_{z-1}(t) + 0.5N_{z-1}(t) + P_z(t) - 0.5D_z(t) + 0.5N_z(t) + 0.5N_z(t+1)(1-g)}{1 + 0.5m_z(t+1) - 0.5n_z(t+1)g}$$
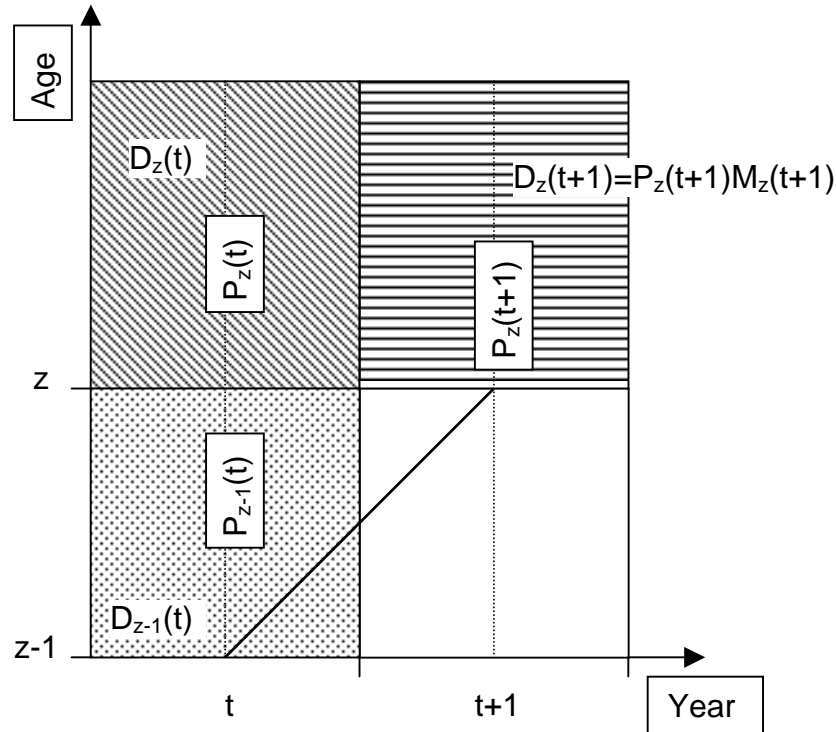
Figure 3. Projection of the Open-ended Age Group

The first two age groups also require special equations in order to take into consideration the separation factor of infant deaths, k (see figure 4).

$$(8) \quad P_0(t+1) = \frac{0.5[B(t) + B(t+1) - D_0(t)(1 - k(t)) + N_0(t+1)(1-g)]}{1 + 0.5m_0(t+1)(1-k(t+1)) - 0.5n_0(t+1)g}$$

where:

$B(t)$ = births in the year centered on t.

$$(9) \quad P_1(t+1) =$$

$$\frac{P_0(t) - 0.5D_0(t)k(t) - 0.5D_0(t+1)k(t+1) + 0.5N_0(t) + 0.5N_1(t+1)(1-g)}{1 + 0.5m_1(t+1) - 0.5n_1(t+1)g}$$

The births $B(t+1)$ for the projection year must be determined before equations (8) and (9) can be used. This is done based on the age-specific fertility rates, $f_x(t+1)$, in year t+1 for women aged x:

$$(10) \quad B(t+1) = \sum_{x=15}^{49} f_x(t+1) P_x(t+1)$$
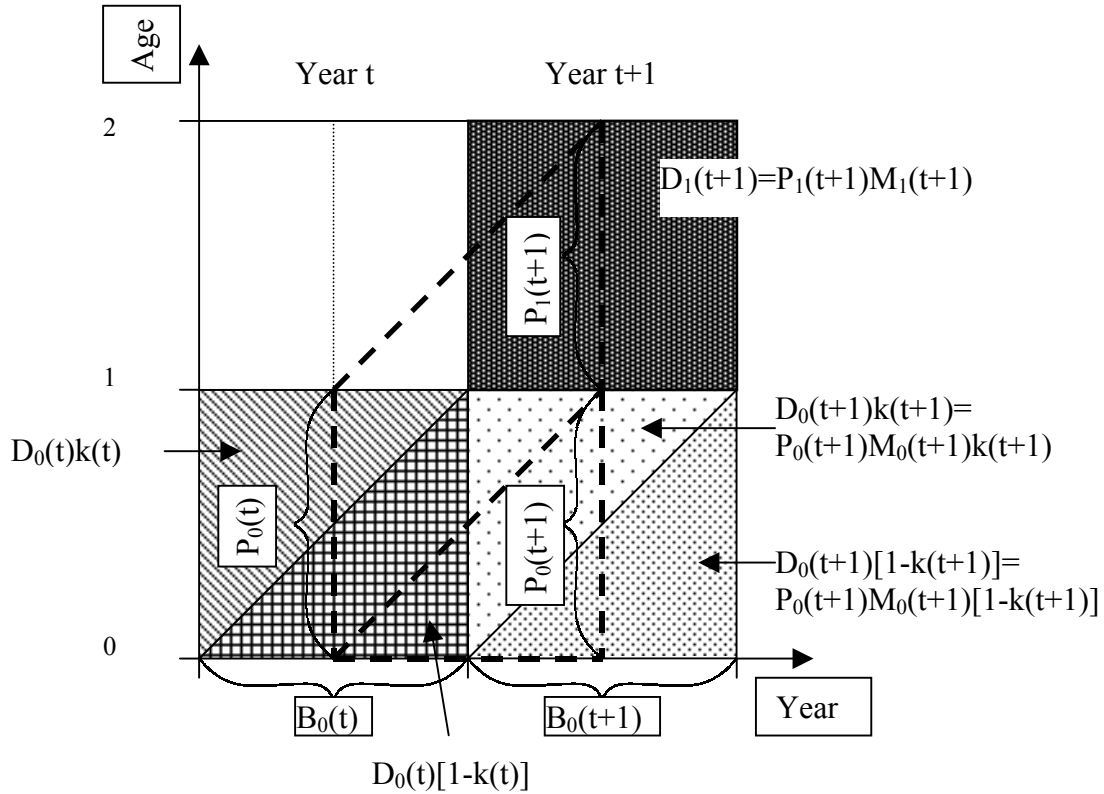
Figure 4. Projection of the Population from Birth to Age 1

<u>2. Interpolation</u>

     The values of age-sex-specific data (central death rates, migration rates, or
fertility rates) for years not given as input are determined by the following rules.
In general, values are linearly interpolated between input values, and values before
the first input value and values after the last input value are held constant at the
level of the nearest input value.

     Thus, if $x_1, x_2, \ldots, x_n$ are the input values for the years $t_1, t_2, \ldots, t_n$, then the
value x for the year t is determined as follows:

   $x = x_1$ if $t <= t_1$

   $x = (1-w)x_i + wx_{i+1}$ if $t_i <= t <= t_{i+1}$

      where $w = (t - t_i)/(t_{i+1} - t_i)$

   $x = x_n$ if $t >= t_n$

     Figure 5 illustrates this in a case where there are three input values x1=5, x2=25, and x3=30, which correspond
to years t1, t2, and t2, respectively. The value for t shown (half way between t1 and t2 would be interpolated to 15 in
this case. For years before t1, the value would be x1=5 while for years after t3, the value would be x3=30.
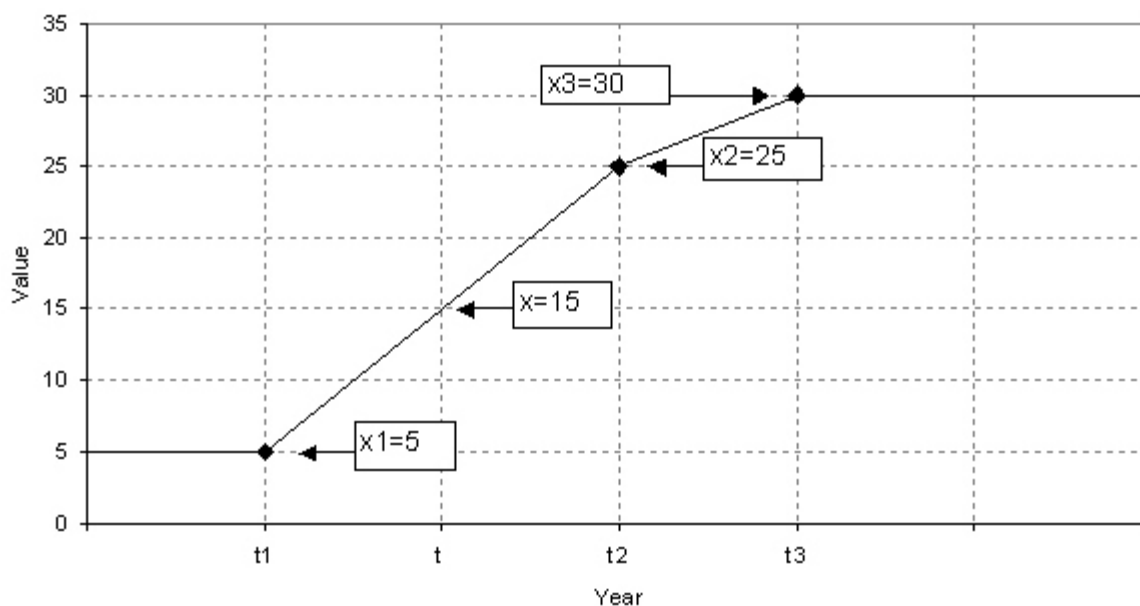
Figure 5. Intepolation Procedure

The age-specific fertility rates for years between successive <u>ASFR</u> record inputs are computed by linear interpolation:

(1) $w = (t - t_1)/(t_2 - t_1)$

(2) $f_x(t) = (1 - w)f_x(t_1) + (w)f_x(t_2)$

where:

        x = age of mother
        f_x = ASFR for women age x
        t_1 = year of previous input ASFR
        t_2 = year of following input ASFR
        t = year desired

When a <u>TFR</u> record is included between two <u>ASFR</u> records, the age-specific fertility rates for the year specified on the <u>TFR</u> record, t, are computed by linear interpolation between the input ASFR's for the nearest preceding and following years using equation (2) above. The weight, w, is computed as:

(3) $w = [TFR(t) - TFR(t_1)] / [TFR(t_2) - TFR(t_1)]$

For the years between TFR inputs or between ASFR and TFR input, the procedure requires 2 steps. First, the TFR for year t is found by linear interpolation between surrounding input TFR values:

(4) $w' = (t - t')/(t'' - t')$

where:

t' = year of previous <u>ASFR</u> or <u>TFR</u> record
t'' = year of following <u>ASFR</u> or <u>TFR</u> record

(5) $TFR(t) = (1 - w')TFR(t') + w'TFR(t'')$

Then the ASFR's are found using equations (3) and (2) above, as if a <u>TFR</u> record with the value TFR(t) were included.

If a <u>TFR</u> record precedes the first <u>ASFR</u> record (and associated age-specific fertility rates) or follows the last <u>ASFR</u> record, the pattern of fertility from the nearest ASFR specification is used and adjusted to the total fertility rate specified on the <u>TFR</u> record. Between the year of the <u>TFR</u> record and the ASFR record, the TFR values are linearly interpolated as in equation (4) but the ASFR pattern is the same as that specified on the data records following the <u>ASFR</u> record.

3. Rounding

In order to preserve consistency among different values printed by the program, certain values are rounded progressively. Progressive rounding is a procedure used to round a set of ordered numbers which preserves the rounded total. The progressively rounded values, r(i), of a series of values, x(i), are defined as follows:

 x(i) = ith value to be rounded

$$X(i) = \sum_{j=1}^{i} x(j)$$

 where X(0) is defined as equal to zero.

 R[X(i)] = the value of X(i) rounded to the nearest integer

 r(i) = R[X(i)] - R[X(i-1)] = ith progressively rounded value

In most cases, progressive rounding results in the same integer values as individual rounding. However, it often happens that individual rounding results in a set of values that do not sum to the rounded value of the unrounded sum. There are cases where progressive rounding rounds differently, but the difference between the rounded and unrounded values is never greater than 1.0.

In addition to reproducing the rounded total, progressive rounding also reproduces the sum of subsequences which have integral values. Thus, in the case of population data, if integral population figures in 5-year age groups have been subdivided into single-year data based on a mathematical formula (such as the BEERS procedure), progressive rounding provides a way to obtain integral single-year population figures that sum to the input 5-year age group figures.

Progressive rounding is used to obtain integral values of population, deaths, and migrants by single years of age for each sex, and births by single years of age of the mother.

The age-specific fertility rates, infant mortality rates, expectations of life at birth, and migration rates printed by the program for subareas are based on the input or on interpolated values. The values for the total country, however, are based on the rounded populations, births, deaths, and migrants by single years of age. The subarea (usually the urban or rural area) values, thus, represent the values (or functions of the values) used to perform the projection, while for the total country the values are an 'actualization' of those rates in terms of integral values. This means, for example, that the life table, computed based on rounded deaths and populations, may not result in the same expectation of life at birth as that printed for a subarea, although the difference should be minimal except in small populations.

In most cases, the impact of such rounding will not be observed. However, if the same life table or ASFR's are used in both areas, it is possible that the values printed for the total country will differ from the values used for the subareas.

4. Mortality

  a. Splitting Data into Single Years of Age

    (1) Ages 5 and over

    For ages 5 and over, input central death rates for 5-year age groups ($_5M_x$ values) are split into single year rates ($_1M_x$, $_1M_{x+1}$, ... $_1M_{x+4}$) by assuming all the single-year rates are equal to the rate for the 5-year age group. This method has the advantage of simplicity and also ensures that the deaths in each 5-year age group will be the same when using the single-year data as when using the 5-year data.

    (2) Ages 1 to 4 years

    Mortality in the age group 1 to 4 years changes more rapidly than at most ages over 5 years, so RUP always treats these ages in a different manner. There are 5 ways that the single-year central death rates for ages 1 to 4 years can be determined: (a) specify the single-year rates directly; (b) use the Coale-Demeny separation factors; (c) specify a particular separation factor; (d) specify a separation factor of 2.0, representing equal rates; or (e) specify the adjustment (*adj*) option. Each of these options is discussed below.

(a)   If the single-year age-specific central death rates (or mortality rates) are provided as input, these values are used without modification for that year.

(b)   When no separation factor is specified, the Coale-Demeny separation factors are used. These values are determined as a function of the infant mortality rate using the formula:

$$k = \begin{cases} a & \text{if } q_0 \leq 0.100 \\ b + cq_0 & \text{if } q_0 \geq 0.100 \end{cases}$$

    where the values of a, b, and c are functions of region and sex:

Parameter	Region	Male	Female
a	West	1.352	1.361
	North	1.558	1.570
	East	1.313	1.324
	South	1.240	1.239
b	West	1.653	1.524
	North	1.859	1.733
	East	1.541	1.402
	South	1.614	1.487
c	All	3.013	1.627

(c)   If a separation factor is specified, the program uses the Coale-Demeny separation factors as an initial try for splitting the mortality into single years, then modifies them to obtain the specified separation factor. Thus, a set of interpolation factors g'_2, g'_3, and g'_4 is determined based on the Coale-Demeny equations shown above and the empirical q_0 value. These interpolation factors imply a separation factor k'_1 where:

$$k'_1 = 0.5 + g'_2 + g'_3 + g'_4$$

These values of g'_i are then adjusted to obtain the desired separation factor k_1:

$$d = k_1 - k'_1$$

$$g_i = g'_i + d/3$$

(d)   If the input separation factor is 2.0, then all 4 single-year values for ages 1, 2, 3, and 4 are assumed to be equal to the value for the 4-year age group, 1 to 4 years of age:

$$M_x = {}_4M_1 \qquad \text{for x = 1, 2, 3, and 4}$$

(e)   When the input age-specific central death rates are for the base year, it may be desirable to obtain the same number of deaths as implied by the abridged life table and the population in the age groups under 1 year, 1 to 4 years, and 5-year age groups 5 to 9 years and above. This can be accomplished in two ways. The first is to assume that the single-year rates are all equal to the 4-year rate for ages 1 to 4 years as indicated in (d) above. The second is to specify the *adj* option on the <u>MX</u> record. This will cause the program to adjust the splitting of the age-specific central death rates to obtain the same number of deaths implied by the population aged 1 to 4 years and the value of ${}_4M_1$. This is accomplished by an initial splitting of ${}_4M_1$ into M'_x values for ages 1 to 4 years as indicated above in (b) or (c). However, an input separation factor may not be reproduced as a result of the adjustment. Then the deaths based both on the single-year population values and on the 4-year age group are computed:

$$_4D'_1 = \sum_{x=1}^{4} M'_x P_x$$

$$_4D_1 = {}_4M_1 \sum_{x=1}^{4} P_x$$

$$M_x = M'_x \frac{_4D_1}{_4D'_1} \qquad \text{for x = 1, 2, 3, and 4}$$

b. Life Tables

The symbols representing the life table functions are as follows:

$_nd_x$ Life table deaths between exact ages x and x+n.

e_x Expectation of life at age x.

$_nk_x$ Separation factor of deaths.

l_x Life table survivors to exact age x.

$_nL_x$ Life table stationary population in the age group x to x+n years, or person-years lived between exact ages x and x+n years by a birth cohort of l_0.

$_nm_x$ Age-specific central death rate for the population between exact ages x and x+n. The symbol m_z is used in the equations below to refer to the central death rate for the population age z years and over.

$_nq_x$ Probability of dying before exact age x+n given survival to exact age x.

$_nS_x$ Life table survival ratio, or the probability of a cohort in the age group x-n to x surviving n years, to the age group x to x+n. $_nS_0$ is the probability of an n-year birth cohort surviving from birth to the age group 0 to n. $_nS_z$ is the probability of persons aged z-n years and over surviving to ages z and over, n years later.

T_x Life table stationary population ages x and over, or the number of person-years lived in the ages x and over by a birth cohort of l_0.

If the age group width variable (n above) is dropped, then n is assumed to be 1. For example:

$$q_0 = {_1q_0}$$

The following equations indicate how the life table measures are computed starting from the $_nm_x$ values estimated based on the input mortality data.

```
        / n/2                          if x>0 and n=1, or x>5 and n=5
  nkx = <
        \ user input or                if x=0 and n=1, or x=1 and n=4
           Coale-Demeny formula
```

$$_nq_x = \frac{n \; _nm_x}{1 + \; _nk_x \; _nm_x}$$

$$l_{x+n} = l_x (1 - \; _nq_x)$$

$$_nd_x = l_x - l_{x+n}$$

$$L_0 = l_1 + k_0 d_0$$

$$_nL_x = \; _nk_x \; l_x + (1 - \; _nk_x) \; l_{x+n}$$

$$e_z = 1/m_z$$ where z is the initial age of the last, open-ended age group.

$$e_{80} = 3.725 + 6.25l_{80}$$ if m_z is not entered as input and $z=80$ (see note below if $z<80$ and m_z is not given).

$$T_z = l_z e_z$$

$$L_z = T_z$$

$$T_z = \sum_{t=z}^{t} {}_nL_t$$

If the lower bound of the last age group, z, is not equal to 80, and m_z is not provided (because q_x values were input), then the value of e_z is computed by extrapolating the ${}_nq_x$ values up to age 80, and then using the formula for e_{80} shown above. The ${}_nq_x$ values are extrapolated as follows:

$$R = \frac{{}_nq_{z-n}}{{}_nq_{z-2n}}$$

$${}_nq_{x+n} = R \; {}_nq_x$$ for $x=z-n$ to 70

$$l_{80} = l_z(1-{}_nq_z)(1-{}_nq_{z+n})\dots(1-{}_nq_{75})$$

5. Integrating Reported Deaths

The use of registered deaths (with or without adjustment) in making projections allows the user to incorporate new vital registration data into a projection on a timely basis. The flexibility of the death data input allows for the different types of tabulations that may be made of the data, from preliminary totals to detailed data by single years of age.

The program implements this procedure as follows:

(1)   The program makes test projections with two life tables (the most recent and the closest one that follows). When there are several years of death input, it uses the life table estimated from a prior year of death input as the most recent life table.

(2)   It then compares deaths resulting from these projections, age group by age group, to the input deaths; and a new set of $_nm_x$ values is estimated by interpolation.

(3)   The program then uses these interpolated m_x values to project again and compares the resulting deaths to the input.

(4)   Lastly, it proportionally adjusts the latest m_x values to obtain the input deaths.

(5)   The whole procedure is repeated until the sum of the absolute differences between the estimated and input deaths by age is less than 0.4. If this convergence is not achieved within 10 iterations, then a warning message is issued, but the program continues.

In order for the program to perform step (1) above, the user must always include mortality patterns for a time before and after the years for which death data are input. In most cases, this pattern corresponds to that of a benchmark life table that predates the death data and an ultimate life table to be used to get interpolated life tables for the projected years.

In addition, since the life table for the year with <u>DTH</u> record input cannot be determined until the projection gets to that year, it cannot be used to interpolate $_nm_x$ values for earlier years. Operationally, this means that <u>DTH</u> records can be for the base year (if pre-base year <u>MX</u> or <u>MLT</u> records are present) or a <u>DTH</u> record must be for a year immediately following a year with MX, QX, MLT, or DTH data.

6. Integrating Reported Births

The integration of actual data on births into RUP is much simpler. This is because total births can be used directly in the projection. When ASFR's are used, they are applied to the projected women to estimate births, then the births are used to project the population under age 1. When data on births are provided as input, the program skips using the ASFR's and uses the births directly.

In order to estimate the ASFR's, the program must compare input births (possibly by age of mother) to the surrounding ASFR's. There are several possible situations:

(1)   No ASFR's provided, births given by age. In this case, the program computes the ASFR's from births and female population.

(2)   One set of ASFR's provided (before or after birth data). If no births provided by age, the program multiplies the ASFR's by the female population and then proportionally adjusts the ASFR's to the reported births. If births are given by age, it adjusts the ASFR's within each of the input age groups.

(3)   At least two sets of ASFR's provided (one before and one after). In a manner similar to the way the deaths are adjusted, the program multiplies each of the ASFR's by the female population, then interpolates between the two ASFR's to match the input births (by age, if necessary).

H. Error Messages

1. Introduction

This section presents the error and warning messages you are likely to encounter when running RUP. If you get an error or warning message, look up the message in this section. Then check the inputs indicated as the probable cause of the problem and try to make the appropriate corrections. Once an error or warning is detected, the program will often generate other errors/warnings that will be fixed by correcting the first problem. Be sure to look at the input file as a whole to ensure that all desired inputs are present in the proper order. Refer to table 2 (page 34) for guidelines on the order of parameter records.

Check all parameter records and data records to ensure that all inputs have been entered accurately and in the correct columns.

Be careful not to confuse the small letter "l" with the number one (1), nor the capital letter 'O' with the digit zero (0).

If you detect an error, look at the input listing file (this should have the same name as your input file except with the extension .OUT). This is where most of the errors/warnings will be listed.

If you cannot resolve the error, please fill out and send in the error report form located on pages 107-108, so that we can try to correct the problem.

2. FORTRAN Run-Time Errors Displayed on the Monitor

These error messages indicate problems in trying to execute the RUP program, usually involving arithmetic or input/output devices. The cause of the problem is sometimes difficult to identify, but the best approach is to determine approximately what year the program was working on and check the inputs for that year (as well as for the years it may have been using for interpolation).

F6099 INTEGER overflow
F6100 INTEGER overflow
> The program computed an integer value too large to store.
>
> Check your input file for data in the wrong location, missing decimal points, or incorrect data.

F6101 invalid INTEGER
> The program detected an illegal character when trying to read an integer value. The only characters allowed are:
>
>   space or +-0123456789
>
> Check your input file for letters or other extraneous characters in numeric fields.

F6103 invalid REAL
> The program detected an illegal character when trying to read a real value. The only characters allowed are:
>
>   space or +-.0123456789
>
> Check your input file for letters or other extraneous characters in numeric fields.

F6104 REAL math overflow
> The program computed a real number that is too large to store.
>
> Check your input file for data in the wrong location, missing decimal points, or incorrect data.

F6422 no space left on device
> You have run out of space on a device (probably a disk).
>
> Review where your output files are being stored and check how much space is available. You may need to delete some files or send your output files to a different disk (e.g., a hard disk) or reduce the amount of output requested.

M6101 Floating point error: invalid
> The program attempted to make a computation involving a storage location that does not contain a valid number.
>
> Report the problem using the error report form located on pages 107-108.

M6103 divide by zero
> The program tried to divide a number by zero.
>
> Check your input data for zero (0) values, and look at what data are being used for interpolation.

M6104 overflow
> The program computed a number that is too large to store.
>
> Check your input file for data in the wrong location, missing decimal points, or incorrect data.

M6105 underflow

The program computed a number that is too small to be represented accurately.

Check your input file for data in the wrong location, missing decimal points, or incorrect data.

R6003 integer divide by 0

The program has tried to divide a number by zero.

Check your input data for zero (0) values, and look at what data are being used for interpolation.

3. RUP Errors/Warnings Displayed on the Monitor

CHECK OUTPUT LIST FILE FOR ERRORS/WARNINGS

*** NUMBER OF ERRORS/WARNINGS = xx
FOR DETAILS, CHECK OUTPUT LISTING FILE file.OUT

The program detected *xx* error or warning conditions while scanning your input file or performing the projection. If a serious error was detected, the following message will also be displayed:

*** AT LEAST ONE SERIOUS ERROR WAS FOUND ***

Check your output listing file for error messages or warnings.

ERROR ENCOUNTERED TRYING TO OPEN YOUR INPUT FILE
DO YOU WANT TO RE-ENTER THE FILE NAME? (Y/N)

The program could not find your input file.

Recheck the drive, path, and spelling of the filename. If you see your mistake, type **"Y,"** press **<Enter>** and then re-enter the proper input file name when prompted. Otherwise, type **"N,"** press **<Enter>**, then locate the input file (e.g., using the DOS DIR command).

4. Errors/Warnings Printed in the RUP Input Listing File

*** E0MQ ERROR 200 : INVALID REGION= i

The region code sent to the subroutine E0MQ was not 1, 2, 3, or 4.

Check your REG (Coale-Demeny model life table region code) input record.

*** E0MQ ERROR 240 : INVALID SEX CODE= i

The sex code sent to subroutine E0MQ was not 1, 2, or 3.

Check the sex codes on your mortality input parameter records.

*** E0MQ ERROR 280 : INVALID NUMBER OF AGES= i

The number of age groups sent to subroutine E0MQ was not valid.

Probable program error, please fill out and send in the error report form located on pages 107-108.

*** E0MQ ERROR 520 : s nQ x= xxxx.xxxxx MX=xxxx.xxxx
*** E0MQ ERROR 520 : QX (i)= XXXXXXXXX.XXXXX

The *i*-th probability of dying ($_nq_x$) sent to subroutine E0MQ is invalid. Data is for males if s=M, females if s=F.

Check mortality input data.

*** E0MQ ERROR 670: UNABLE TO CLOSE LIFE TABLE BASED ON QX, TOO MANY AGES
The program encountered a $_nq_x$ value for an age greater than 80.

When QX input records are used, the life table is closed using the Coale-Demeny (1966) method, which assumes the life table ends at age 80. If your open-ended age group is beyond 80+, you must use MX input.

*** E0MQ ERROR 680: EXTRAPOLATED QX VALUE FOR AGE GROUP i = XXXXXXXXXX.XXXXX
The program encountered $_nq_x$ input for a life table that ends before age 80. When QX input records are used, the life table is closed using the Coale-Demeny (1966) method, which assumes the life table ends at age 80. If your open-ended age group is less than 80+, the program extrapolates your $_nq_x$ values to close the life table. If you get this error, an extrapolated $_nq_x$ value is less than 0 or greater than 1.

Examine your QX input data (particularly the last two age groups) to see if there are large changes, or use MX record inputs.

*** E0MQ WARNING: QX=0 FOR GROUP # i
The program detected a zero $_nq_x$ value.

If this is not expected, note the last year that has been displayed on the monitor and examine the mortality input data for the next year. The age group number *i* may be either single or 5-year age group.

*** GETFERT ERROR: IFR= i, NFERT= j
The program was looking for the *i*-th fertility input, but encountered only *j* fertility inputs.

Check your fertility inputs.

**** GETFERT WARNING 1410: ASFR EXTRAPOLATION:
TFR 1 = xxx.xxxx
TFR 2 = yyy.yyyy
DESIRED TFR = zzz.zzzz
You are trying to interpolate between two sets of ASFR's with TFR's of xxx.xxxx and yyy.yyyy. The value to which you are trying to interpolate, zzz.zzzz, is outside the range defined by the ASFR's you are interpolating between.

Although this may work satisfactorily, if xxx.xxxx and yyy.yyyy are close together, and/or any ASFR moves in the opposite direction from the TFR (i.e., the ASFR gets larger when the TFR gets smaller), the interpolated values can be unrealistic, including negative or extremely high values. If the TFR values are very close, simply repeat the ASFR's for the year you want to interpolate (i.e., use the same pattern) and follow that ASFR record with a TFR record containing the desired TFR value.

*** GETMIG ERROR 1025--INPUT MIGRATION DATA CANNOT
*** BE FOR BOTH SEXES
The program encountered migration inputs (MIGN, MIGR, RUMN, and RUMR records) that specify data for both sexes combined.

Estimate the migration values by sex.

*** GETMIG ERROR 9000--REQUEST MADE TO INTERPOLATE MIGRANTS TO A TOTAL BASED ON A PATTERN WITH A
*** ZERO TOTAL
One set of migrants to use in interpolation has a net migration total of zero.

Estimate net numbers of migrants for another year where the net migration is not zero, which can then be used for interpolation.

*** GETMORT ERROR: IM=i
Current mortality pointer = *i*.

Check your mortality inputs.

*** GETMORT ERROR: PROCESSING ENDING DUE TO PREVIOUS ERROR ***

> The subroutine GETMORT could not continue due to previous errors.
>
> There should be another error message explaining the problem. If not, please fill out and send in the error report form located on pages 107-108.

**** GETMORT WARNING 789: LT EXTRAPOLATION
E0 1 = xx.xx
E0 2 = yy.yy
DESIRED E0 = zz.zz

> You are trying to interpolate between two life tables with e_0 values of xx.xx and yy.yy. The value to which you are trying to interpolate, zz.zz, is outside the range defined by the life tables you are interpolating between.
>
> Although this may work satisfactorily, if xx.xx and yy.yy are close together, and/or any $_nm_x$ value moves in the same direction as the e_0 (i.e., the $_nm_x$ gets larger when the e_0 gets larger), the interpolated values can be unrealistic, including negative or extremely high values.
>
> Look carefully at the two mortality patterns you are using to interpolate. In some cases, you may need to construct a set of $_nm_x$ values for the year you wanted to interpolate.

*** GETMORT ERROR 930: s nM(x) VALUES USED FOR INTERPOLATION: xxxx.xxxxx xxxx.xxxxx

> One or more of the values to be used for interpolation of Mx values is invalid. Check mortality inputs for the years surrounding where the error occurs.

*** GETMORT ERROR 7251: ZERO BASE MORTALITY CANNOT BE USED TO GET NON-ZERO
DEATHS FOR AGE X

> If the implied deaths are zero, the program cannot estimate non-zero deaths. Try combining DTH input age groups so the implied deaths will be greater.

***GETSXRB ERROR: ISX=n NSXRB=m

> Requested sex ratio at birth value number *n*, but only *m* values were recorded as input. Probably program error, please fill out and send in the error report form located on pages 107-108.

*** INTPLT ERROR 300: s nM(x) VALUES USED FOR INTERPOLATION: xxxx.xxxxx xxxx.xxxxx

> One or more of the values to be used for interpolation of Mx values is invalid. Check mortality inputs for the years surrounding where the error occurs.

***MIGIN ERROR 160: BOTH MIGRATION RATES AND NUMBERS HAVE BEEN READ

> At this time, only migration rates or net numbers of migrants can be input for each type of migrant (MIGR or MIGN inputs and RUMR or RUMN inputs).
>
> Convert all migration inputs for each type to either rates or net numbers of migrants. The input international and internal migration data do not both need to be rates or migrants.

*** MLTMX ERROR 180: INVALID SEX CODE= i

> The sex code sent to subroutine MLTMX, *i*, was not 1 or 2.
>
> Check mortality inputs.

*** MLTMX ERROR 220: INVALID REGION CODE= i

> The model life table region code, *i*, was not 1, 2, 3, or 4.
>
> Check your REG input record.

*** MLTMX ERROR 360: INVALID SEX OR REGION FOR E0=99.0
*** NSEX=i, LSEX=j, NREG=k, LREG=l

You are using the value 99 for life expectancy when using model life tables to get the corresponding life table for the opposite sex, and the parameters do not match.

Check your $\underline{MLT}$ input. On the previous call to create a model life table, the program requested sex=j for region=l. The second call requested sex=i and region=k. In order for this procedure to work, i $\underline{\text{must not}}$ be equal to j, and k $\underline{\text{must}}$ equal l.

*** MLTMX ERROR 460: MORE THAN 10 ITERATIONS

It took more than 10 iterations to solve for the requested model life table. This should not occur.

Check your input data for mortality. This could also reflect a hardware problem in the computations.

*** MLT10 ERROR 180: E10= xx.xx, I=i ALGQX= y

The program cannot compute a model life table because it is trying to compute a number that is too large ($y \geq 170$).

Probable program error, please fill out and send in the error report form located on pages 107-108.

*** MXMOD WARNING: MORE THAN 25 ITERATIONS
BUT E0 CONVERGED WITHIN 0.01 YEARS

The MXMOD procedure to extrapolate life tables did not converge within a tolerance of 0.001 years to your requested life expectancy after 25 iterations, but the result was within 0.01 years.

Check your mortality inputs. This indicates that you are using the alternate $\underline{MXM}$ record procedure, which involves extrapolating $_nm_x$ values based on Coale-Demeny model life tables. This error may result from an empirical pattern of mortality that is significantly different from the Coale-Demeny region specified on the $\underline{REG}$ record, and a different region may work better. This error can also occur at very low levels of mortality (high e_0 values). Use of the interpolation method, by including an "ultimate" life table, will eliminate this error and will usually result in more realistic patterns of mortality.

*** MXMOD ERROR: MORE THAN 25 ITERATIONS
E0= xx.xx, E0NEW= yy.yy,
CURRENT E0= zz.zzz

The MXMOD procedure did not converge to within 0.01 years of the desired e_0 value after 25 iterations.

See the notes for the previous message. Try a different region code on the $\underline{REG}$ record, or include an "ultimate" life table.

**** PROJ ERROR 1710: NEGATIVE POP. FOR AGE i

The projection estimated a negative population for the single age i.

This is usually the result of net numbers of migrants too high for the population in the age group. Check your population ($\underline{POP}$) and migration ($\underline{MIGN}$, $\underline{MIGR}$, $\underline{RUMN}$, or $\underline{RUMR}$) inputs.

*** QMO4 ERROR -- NO MO OR QO VALUE GIVEN ***

No valid infant death rate or infant mortality rate was passed to subroutine QM04.

Check your mortality input.

*** QM04 ERROR 41: INVALID SEX CODE = i
*** QM04 ERROR 41 = INVALID REGION CODE = j

The sex code, *i*, or the region code, *j*, was invalid. Valid sex codes and 1, 2, or 3, and Coale-Demeny region codes are 1, 2, 3, or 4. Check REG input record and mortality inputs.

*** QMO4 ERROR 130: SEPO= xxxx.xxxx

        An invalid separation factor was passed to the QM04 subroutine.

        Check your mortality input.

*** QMO4 ERROR -- NO M14 OR Q14 VALUE GIVEN ***

        No valid central death rate or mortality rate for ages 1-4 was passed to subroutine QM04.

        Check your mortality input.

*** QMO4 ERROR 230: SEP1= XXXXXXX.XXXX

        An invalid separation factor was passed to the QM04 subroutine.

        Check your mortality input.

*** QMO4 ERROR 410: QX (i) = xxxx.xxxx

        The program detected an invalid $_nq_x$ value of xxxx.xxxxx.

        Check your mortality input.

*** RDPAR ERROR 220: INVALID RECORD TYPE
tttt rest of record

        The program does not recognize the record type *tttt* (at this location).

        Review your input file.
-      If you have too many lines of data records, the program may assume one of them is a parameter record.
-      The asterisk may be missing from a comment record in column 1.
-      The record type *tttt* may not have been entered correctly or it does not start in column 1.

*** RDPAR ERROR 320: INVALID SEX CODE

        A parameter record contains a sex code other than M, F, B, E, or a blank.

*** RDPAR ERROR 500: I/O ERROR

        An I/O error has occurred while reading your input file.

        Check your input file to see if it can be read by another program (e.g., the editor you used to create it). Possible hardware error or problem disk.

*** RUPIN ERROR 10
*** INVALID SEX CODE

        The sex code on the parameter record is invalid.

        Check the indicated parameter record, and review the valid sex codes for this type of record.

*** RUPIN ERROR 20
*** INVALID AGE CODE

        The age code on the parameter record is invalid.

        Check the indicated parameter record, and review the valid age codes for this type of record.

*** RUPIN ERROR 30
*** INVALID YEAR

        The year on the parameter record is invalid.

        Check the sequence of years for this component/input type, the base year of the projection (specified on the POP record), and the final projected year (specified on the PROJ record).

*** RUPIN ERROR 40
*** INVALID NO. OF AGES
   The number of ages of input is invalid.

   Check the indicated parameter record, and compare the number of ages indicated to that indicated on the <u>N</u> or <u>N5</u> record. Also check to be sure the age code is correct.

*** RUPIN ERROR 50
*** INVALID SEQUENCE OF YEARS
   The sequence of years is invalid for the current parameter record.

   Check to be sure all the inputs for each component (fertility, mortality, international migration, and rural/urban migration) are in chronological order.

*** RUPIN ERROR 60
*** DATA NOT FOUND FOR BOTH SEXES
   The program did not find parameter records for the current input type to define the input for each sex.

   Check your input file for missing input or a sex code error.

*** RUPIN ERROR 70
*** DATA WILL EXCEED STORAGE FOR THIS COMPONENT
   The current parameter record provides too many data inputs (parameter records or data items) for this component.

   Consider alternate ways of specifying the data (e.g., letting the program interpolate, using 5-year age group input rather than single years) to conserve space.

*** RUPIN ERROR 80
*** SUPPLEMENTARY DATA FOR SAME SEX AND YEAR MUST BE SINGLE YEARS
   Supplementary single year data is misspecified.

   Check the input to be sure the supplementary data:

   (1) Immediately follow the corresponding 5-year data.
   (2) Specify the same sex (or blank sex field).
   (3) Specify the same year (or blank year field).

   Check the input data to see if this error message may have resulted from miscoding the sex or year field on a parameter record when supplementary single year data are not being specified.

*** RUPIN ERROR 120 : tttt PARAMETER RECORD NOT EXPECTED HERE
   The *tttt* parameter record should not be in this location in the input file.

   Refer to table 2, page 34, of the RUP documentation for the rules regarding the order of parameter records.

*** RUPIN ERROR 180 : UNIDENTIFIED PARAMETER RECORD
ttttsayyyy rest of record
   The program does not know how to process the *tttt* parameter record.

   Check your input file to see if you may have misspelled the parameter record type.

*** RUPIN WARNING 220 : TITL RECORD ALREADY PROCESSED
   The program expects only one <u>TITL</u> parameter record. The program will ignore this record.

   Remove the extra TITL record and following data records. Check to see if an <u>AREA</u> or <u>TOT</u> record is missing.

*** RUPIN ERROR 260 : NTITL MUST BE IN RANGE 0 TO 7

The program encountered a <u>TITL</u> record where the number of title lines (*ntitl*) was outside the valid range of 0 to 7.

Check the <u>TITL</u> record to be sure the value of *ntitl* is between 0 and 7 (0 or blank default to a value of 1). Remember that the number of title records plus number of special age groups must be less than or equal to 8 (*ntitl* + *nspag* ≤ 8).

*** RUPIN ERROR 440 : MORE THAN ONE PROJ RECORD

The program found more than one <u>PROJ</u> record in the input file.

Remove one of these records.

*** RUPIN ERROR 500 : INVALID YEAR ON PROJ RECORD

The final projection year is before the base year of the projection.

Change either the base year (on the <u>POP</u> record) or the projected year (on the <u>PROJ</u> record).

*** RUPIN ERROR 580 : MORE THAN ONE N5 OR N RECORD

The program encountered more than one <u>N</u> or <u>N5</u> record.

Remove one of the records.

*** RUPIN ERROR 620 : N5 MUST BE IN RANGE 11 TO 21

The value of *n5* (number of 5-year age groups) on the <u>N5</u> record is less than 11 or greater than 21.

Enter a valid value for *n5*.

*** RUPIN ERROR 700 : N MUST BE IN RANGE 51 TO 101

The value of *n* (number of single years of age) on the <u>N</u> record is less than 51 or greater than 101.

Enter a valid value for *n*.

*** RUPIN ERROR 740 : N MUST BE 1 + (MULTIPLE OF 5)

The program found an invalid value of *n* on the <u>N</u> parameter record. The value of *n* (number of single years of age) must be one more than a multiple of 5 (e.g., 76, 81, 86, ... 101).

Enter a valid value for *n*.

*** RUPIN WARNING 880 : SXRB OUTSIDE RANGE OF 0.9 TO 1.2

The sex ratio at birth is outside the expected range. The ratio should be male births per female birth (NOT per 100 female births).

Check to make sure the value for the sex ratio at birth is correct.

*** RUPIN ERROR 940 : MORE THAN ONE REG RECORD FOR THIS AREA

The program found a <u>REG</u> record has already been processed for this area. Delete one <u>REG</u> record or check to see if an <u>AREA</u> or <u>TOT</u> record is missing.

*** RUPIN ERROR 980 : REG VALUE MUST BE 1, 2, 3, OR 4

The region code, *reg*, on the <u>REG</u> record must have a value of:
    1 = West
    2 = North
    3 = East
    4 = South

Check your input file to make sure the *reg* code is correct and in the proper column (20) of the <u>REG</u> record.

*** RUPIN ERROR 1040 : MORE THAN ONE SPAG RECORD
The program found a <u>SPAG</u> record has already been processed for this area.

Delete one <u>SPAG</u> record or check to see if an <u>AREA</u> or <u>TOT</u> record is missing.

*** RUPIN ERROR 1080 : NSPAG MUST BE IN THE RANGE 1 TO 7
The number of special age groups, *nspag*, on the <u>SPAG</u> record is less than 1 or greater than 7.

Check your input to be sure you have entered the correct number in column 20 of the <u>SPAG</u> record.

*** RUPIN ERROR 1180 : INVALID VALUE FOR SPECIAL AGE GROUP i : j - k
The i-th special age group, specified as j to k, is invalid. This results when:
k is less than j, or
j is less than 0

Check your input to be sure your age group has been entered correctly in the proper columns.

*** RUPIN ERROR 1340 : AREA= i, PHASE= j
The program was processing area i during phase j.

Probable program error, please fill out and send in the error report form located on pages 107-108.

*** RUPIN ERROR 1480 : NO TITLE RECORDS
The program could not find the <u>TITL</u> record input.

Check your input file to be sure this is included with the associated data records containing the title for the run.

*** RUPIN ERROR 1520 : NO N OR N5 RECORD
The program could not find the <u>N</u> or <u>N5</u> record input.

Check your input file to be sure one of these records is included.

*** RUPIN WARNING 1585 : NUMBER OF TITLE RECORDS PLUS NUMBER OF SPECIAL AGE GROUPS MUST BE 8 OR LESS
The program found that the number of title records (following the <u>TITL</u> record) plus the number of special age groups (specified on the <u>SPAG</u> record) was more than 8.

Check both records to see what was specified. Remember that there are several standard special age groups, so limit your <u>SPAG</u> input to only those additional groups that are needed.

*** RUPIN ERROR 1600 : NO PROJ RECORD
The program could not find the <u>PROJ</u> record input.

Check your input file to be sure it is included.

*** RUPIN ERROR 1760 : NO POP RECORD FOR area name
The program could not find a population input (<u>POP</u> record).

Check your input file to make sure it includes the <u>POP</u> records with the base population data.

*** RUPIN ERROR 1800 : NO MX, QX, OR MLT RECORDS FOR
area name
The program could not find mortality data by age for the current area.

Check your mortality input to be sure it includes at least one <u>MX</u>, <u>QX</u>, or <u>MLT</u> record. Remember that <u>DTH</u> input requires patterns of mortality for a prior and following year.

*** RUPIN ERROR 1821 : NO MX, QX, OR MLT AFTER DTH
        The program could not find mortality data by age for the current area after <u>DTH</u>
        record input.

        Check your mortality input to be sure it includes at least one <u>MX</u>, <u>QX</u>, or <u>MLT</u>
        record after the <u>DTH</u> record. Remember that <u>DTH</u> input requires patterns of
        mortality for a prior and following year.

*** RUPIN ERROR 1840 : NO ASFR RECORD FOR area name
        No age-specific fertility data were input for the current area.

        Check your fertility input to include at least one <u>ASFR</u> record.

*** RUPIN ERROR 1880 : NO MIGRATION DATA BY AGE FOR
                    area name
        International migration input (<u>MIGN</u> records) was given for at least one year,
        but no data by age were specified.

        Check your migration input to be sure there are migration data by age for at
        least one year.

*** RUPIN ERROR 1920 : NO INTERNAL MIGRATION BY AGE FOR
                    area name
        Internal migration input (<u>RUMN</u> records) was given for at least one year, but no
        data by age were specified.

        Check your migration input to be sure there are migration data by age for at
        least one year.

*** RUPIN WARNING 1930 : NO INTERNAL MIGRATION DATA FOR
                    area name
        The program could not detect any internal migration data for this area, which
        was not designated as the total.

        This is a warning only, and in many cases the assumption of no internal
        migration may be acceptable.

*** RUPIN WARNING 1960 : NO REG RECORD FOR area name
*** WEST REGION WILL BE USED IF NECESSARY
        The program could not find a <u>REG</u> record in the input file, but the program will
        use the west model region where needed.

        If you wish to use a different Coale-Demeny region, include a <u>REG</u> record with
        the desired region code in column 20.

*** RUPIN ERROR 2000 : NO SXRB RECORD FOR area name
        The program could not find the <u>SXRB</u> record input.

        Check your input file to be sure it is included.

*** RUPIN ERROR 2012 : INCONSISTENT MORTALITY DATA BY SEX
IMA:
YRMA:
MTYPE:
MAGEA:
MLOCA:
        The input mortality data recorded by the program contain inconsistencies by sex
        (in terms of amount of data, age grouping, type of input, or years of input).

        Check your mortality input for each year to be sure that the same type and age
        groupings of data are specified.

*** RUPIN ERROR 2200 : MULTIPLE POP RECORDS FOR area name
        The program has read more than one set of <u>POP</u> records for the given area name.

        Check to see if an <u>AREA</u> or <u>TOT</u> record is missing and one of the sets of POP
        records belongs to another area.

*** RUPIN ERROR 2660 : NOT ENOUGH POPULATION DATA
   Not enough age groups of population data (single years) were specified compared
   to the N or N5 record.

   Check columns 11-20 of the POP record to ensure the correct number of age groups
   was specified.

*** RUPIN ERROR 3000 : NOT ENOUGH POPULATION DATA
   Not enough age groups of population data (5-year age groups) were specified
   compared to the N or N5 record.

   Check columns 11-20 of the POP record to ensure the correct number of age groups
   was specified.

*** RUPIN ERROR 3100 : NEGATIVE POPULATION FOR AGE i = XXXXXXXXXXX.
   The population for age i is negative.

   Check the POP records for errors in input data or the location of the data in
   the records. This error can occur when the BEERS split of the 5-year age groups
   into single years results in a negative population. If this is the case, you
   should examine the input data carefully to be sure there are no errors or to
   determine whether the negative value is the result of age-misreporting that
   should be smoothed before projecting. If you find the data acceptable, enter
   data by single years of age.

*** RUPIN ERROR 3220 : CONFLICTING BASE YEARS: yyyy VS. zzzz
   POP records contain different base years (some have $yyyy$; others have $zzzz$).

   Correct the input to ensure all POP records have the same year specified.

*** RUPIN ERROR 3280 : EXPECTING SUPPLEMENTARY SINGLE-YEAR DATA
   Data on the current POP record have the same $year$ but not the opposite sex code
   from the previous POP record. This indicates that the current data should be
   supplementary single year age data. However, the sex code is not the same or
   the data are not by single years as expected.

   Check the POP records.

*** RUPIN ERROR 3500 : INVALID SEP0 VALUE
   The input separation factor for infant deaths is outside the range
   $0.02 \leq SEP0 \leq 0.5$ and, therefore, is considered invalid.

   Check the mortality input to be sure the separation factor has been coded in the correct colum

*** RUPIN ERROR 3540 : INVALID SEP1 VALUE
   The input separation factor for ages 1 to 4 years is outside the range $0.5 \leq$
   $SEP1 \leq 2.0$ and is considered invalid.

   Check the mortality input to be sure the separation factor has been coded in the
   correct columns and that the decimal point is located correctly.

*** RUPIN ERROR 4360 : ADJ OPTION CAN ONLY BE SPECIFIED FOR BASE YEAR
   The program found the adj option in column 50 of the MX record, which can only
   be specified for the base year (the year on the POP record).

   Check the MX records to be sure the adj option is only specified for the base
   year.

*** RUPIN ERROR 4390 : ADJ OPTION NOT POSSIBLE WITH QX INPUT
   The program found a non-zero value for adj specified on a QX record.

   Check the QX input in question and either (a) substitute an MX record and
   associated data records, with the adj option included, or (b) remove the non-
   zero adj value from the QX record.

*** RUPIN WARNING 4450 : MX = 0
LOCATION = i SEX CODE = j
The program found an $_nm_x$ value equal to zero.

The program will try to continue, but this may cause further problems.

*** RUPIN ERROR 4460 : INVALID MX VALUE = XXXXXXXXXX.XXXXX
LOCATION = i, SEX CODE = j
The program found an $_nm_x$ value greater than 1.0 or less than 0.0.

Check your mortality input data. Location *i* indicates where the data are located in the storage array. The sex code *j* has the value 1 if male, and 2 if female.

*** RUPIN ERROR 6180 : INITIAL AGE OF 5-YEAR ASFRS MUST BE 10 OR 15
The program found the lower bound of the first 5-year age group of ASFR's (specified in columns 19-20) was neither 10 nor 15.

Check your input ASFR records.

*** RUPIN ERROR 6260 : INITIAL AGE OF SINGLE-YEAR ASFRS MUST BE IN RANGE 10 TO 19
The program found the lower bound of the first single-year age group of ASFR's (specified in columns 19-20) was less than 10 or greater than 19.

Check your input ASFR records.

*** RUPIN ERROR 6360 : INVALID ASFR VALUE = XXXXXXXXXX.XXXXX
An ASFR value is less than 0 or greater than 0.75.

Check the data records following the ASFR record.

*** RUPIN ERROR 6440 : INVALID TFR VALUE
The program detected a TFR value less than 0 or greater than 15.

Check all the input TFR values making sure they are entered in the proper columns and with the decimal point correctly specified.

*** RUPIN ERROR 6500 : INVALID YEAR FOR TFR OR PRIOR DATA NOT ASFR
The year on a TFR input record is invalid (e.g., it precedes the prior fertility input) or it is the same year as the previous fertility input which was not ASFR data.

Check your fertility inputs to be sure you do not have more than one TFR record for any year, and that all fertility inputs are in chronological order.

*** RUPIN ERROR 6640 : RUMN OR RUMR RECORDS NOT EXPECTED HERE
RUMN or RUMR records were found in the TOT section of a projection.

Check the location of all TOT, AREA, RUMN, and RUMR records.

*** RUPIN ERROR 7060 : DSRN CONFLICT
*** DSRN CANNOT EQUAL ii
The *dsrn* field on an output specification record contains a preassigned value.

Check the list of preassigned data-set reference numbers in table 4, page 74, and choose a number not on that list.

*** RUPIN ERROR 7280 : INVALID CODE VALUE
*** CODE VALUES MUST BE IN THE RANGE 0 TO 999999
The code for an area contained on a CODE record is negative or greater than 999999.

Check the CODE record to be sure the *arnum* field (columns 11-20) contains the area code number in the correct location (i.e., it ends in column 20).

*** RUPIN ERROR 7403 -- NO LIFE TABLE BEFORE DTH RECORDS
The program found a <u>DTH</u> record without at least one life table for a year prior
to the death data and for at least one year after the death data. These life
tables can be entered using <u>MX</u>, <u>QX</u>, or <u>MLT</u> records.

Check the mortality input records.

*** RUPIN ERROR 7407 -- NO LIFE TABLE FOR YEAR PRIOR TO DTH DATA
The program found a <u>DTH</u> record without life table input for the year prior to
the death data and for at least one year after the death data. These life
tables can be entered using <u>MX</u>, <u>QX</u>, or <u>MLT</u> records or another <u>DTH</u> record if
there is an <u>MX</u>, <u>QX</u>, or <u>MLT</u> record before all <u>DTH</u> records.
Check the mortality input records.

***RUPRO ERROR 2025: year s AGE x POP=xxxxxxxxxxxx
The population for age x is negative (see value given). Check net migration numbers to be sure you are not
having too many people emigrating.

*** RUPRO ERROR 9011 : IM=ii   NMORT = jj
                      IFR = kk   NFERT = ll
                      IMG = mm   NMIG = nn
                      IRUM = oo   NRUM = pp
An error has occurred in the projection phase: the index pointer for one of the
components exceeds the number of inputs for that component.

Check your component inputs (mortality, fertility, and migration).

*** RUPRO ERROR 9061 : PROCESSING ENDING DUE TO PREVIOUS ERROR
The projection cannot continue due to previous errors.

There should be another error message explaining the problem. If not, please
fill out and send in the error report form located on pages 107-108.

**** RUPTOT WARNING 205 : NEGATIVE POP FOR AGE i
In phase 3 of a projection (aggregation of two areas or computation of a
residual), the program detected a negative population for age *i*. This usually
happens when you are computing a residual area and the two areas projected
(total and one subarea) are not consistent.

Examine the output to determine which component (mortality, fertility, or
migration) seems to be responsible for the problem and correct it.

**** RUPTOT WARNING 215 : NEGATIVE DTHS FOR AGE i
In phase 3 of a projection (computation of a residual), a negative number of
deaths was estimated for age *i*. This usually happens when you are computing a
residual area and the two areas projected (total and one subarea) are not
consistent; the mortality for the subarea implies more deaths than occurred in
the total.

Change your mortality assumptions (patterns of mortality and/or levels of life
expectancy).

**** RUPTOT WARNING 2070 : NEGATIVE BTHS FOR AGE i
In phase 3 of a projection (computation of a residual), a negative number of
births was estimated for age *i*. This usually happens when you are computing a
residual area and the two areas projected (total and one subarea) are not
consistent; the fertility for the subarea implies more births than occurred in
the total.

Change your fertility assumptions (patterns of fertility and/or levels of TFR).

*** RUPTOT ERROR 9061 : PROCESSING ENDING DUE TO PREVIOUS ERRORS, MAXIMUM ERROR CODE= i
The projection cannot continue due to previous errors.

There should be another error message explaining the problem. If not, please
fill out and send in the error report form located on pages 107-108.

*** WARNING -- CONVERGENCE TO DTHS NOT REACHED
>   The program could not reproduce the deaths input from the <u>DTH</u> records.
>
>   Review the two surrounding life tables for consistency of patterns by age and
>   the death inputs for accuracy.

WARNING: PARAMETER RECORD DETECTED BEFORE EXPECTED END OF DATA
>   While reading in data records following a <u>BTH or DTH</u> parameter record, the
>   program detected another parameter record before the expected end of the death
>   data.
>
>   Check the number of age groups specified on the <u>BTH or DTH</u> record, and be sure
>   it agrees with the number of age groups of data in the input file.

RUP ERROR REPORT FORM

If you have a problem with the program that you can not correct, please fill out the reverse side of this form and send it to the address shown below. If possible, include the following as well:

1. A printout showing the error message (if the message is on the screen, press **Shift**-**<Print Screen>** to get a printout).

2. A printout of the RUP input file.

3. A copy of the input file on diskette.

Return to: Peter D. Johnson
               International Programs Center
               U.S. Bureau of the Census
               Room 312, Washington Plaza 2
               Washington, DC 20233-8860
               U.S.A.

Telephone: (301) 763-1410
Fax: (301) 457-3034

Alternatively, send the information, including the RUP input file as an attachment to: peterj@census.gov.

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RUP ERROR REPORT FORM
================================================================================
NAME:
================================================================================
ADDRESS:
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--------------------------------------------------------------------------------
================================================================================
TYPE OF COMPUTER:
--------------------------------------------------------------------------------
RAM SIZE:
--------------------------------------------------------------------------------
SIZE OF HARD DISK:
--------------------------------------------------------------------------------
TYPE OF PRINTER:
================================================================================
DESCRIPTION OF PROBLEM:
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